9212
Bac/Fow/Bac
26443

00026443

NOT TO BE ISSUED
OUT OF THE LIBRARY.

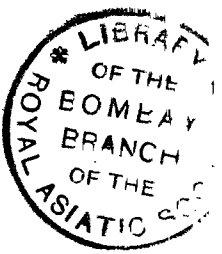
BOMBAY BRANCH
OF THE
ROYAL ASIATIC SOCIETY.
TOWN HALL, BOMBAY.

Digitized with financial assistance from the
Government of Maharashtra
on 18 July, 2018

ENGLISH PHILOSOPHERS

BACON

26443
ac



BY

THOMAS FOWLER, M.A., F.S.A.

PROFESSOR OF LOGIC IN THE UNIVERSITY OF OXFORD; FELLOW OF LINCOLN COLLEGE

15/12/69

London

SAMPSON LOW, MARSTON, SEARLE, & RIVINGTON

CROWN BUILDINGS, 188, FLEET STREET

1881

[*All rights reserved*]

921.2
Bra Paul Sac
26443

00026443

PREFACE.

THE object of this book is to present the character of the revolution which Bacon endeavoured to effect in scientific method, as well as the nature of his philosophical opinions generally, in a form intelligible and interesting to readers who have no technical acquaintance with logic or philosophy. The ground-plan of Bacon's work and the leading ideas with which he was inspired seem to me easily comprehensible by any person who has a general interest in the history and progress of thought. And the place of Bacon, standing mid-way between the old times and the new, is one which cannot be neglected by any one who is desirous of informing himself of the manner in which our modern ideas in science, in philosophy, and in logic have grown out of those which, for so many centuries prior to the Renaissance, held almost undisputed sway over the civilized world. Those who are induced to go more deeply into the topics treated in these chapters may be referred to my edition of Bacon's *Novum Organum* (Oxford, at the Clarendon Press, 1878), and to the valuable edition of Bacon's Philosophical Works, contained in the first five volumes of Ellis and Spedding's Bacon (Longmans and Co.).

To the Delegates of the Clarendon Press I have to express my obligations for the free use which they have allowed me to make of the Introduction and Notes to my edition of the *Novum Organum*. I have sometimes embodied in this work several pages of the Introduction, though it must, of course,

be understood that I have only used the more popular parts of it, and that the present book in no sense replaces my larger work for the purposes of the professed student of logic, philosophy, or the history of science.

To Mr. Spedding I must also express my obligations for allowing me, with that courtesy and kindness which he always extends to those labouring in the same fields with himself, to draw the materials for my chapter on the Life of Bacon from his *Life and Times of Francis Bacon* (Trübner and Co.) and his *Letters and Life of Francis Bacon* (Longmans and Co.). Mr. Spedding must not, however, be held responsible for every remark which I have made or every inference which I have drawn. But, though I have endeavoured to exercise my own judgment on the facts, without slavishly following Mr. Spedding's interpretation of them, I feel bound, after a careful perusal of his volumes, to express my general agreement both with his conception of Bacon's character and with his presentation of the principal passages in Bacon's life. Notwithstanding the mass of prejudice still remaining to be dissipated, I believe that his view of Bacon's personal history is the one which, in the main, will ultimately prevail.[1]

Lincoln College,
Jan. 25, 1881.

[1] It is only fair to the reader to inform him that a different view of Bacon's character and conduct from that maintained by Mr. Spedding, and generally adopted by myself, has been recently advocated by Dr. Abbott in his Introduction to *Bacon's Essays*, in an Article in the *Contemporary Review* for June, 1876, and in a work on *Bacon and Essex*, published in 1877.

CONTENTS.

CHAPTER I.

PAGE

BACON'S LIFE 1

CHAPTER II.

BACON'S WORKS 29

CHAPTER III.

BACON'S SURVEY OF THE SCIENCES 66

CHAPTER IV.

BACON'S REFORM OF SCIENTIFIC METHOD 89

CHAPTER V.

BACON'S PHILOSOPHICAL AND RELIGIOUS OPINIONS 159

CHAPTER VI.

BACON'S INFLUENCE ON PHILOSOPHY AND SCIENCE 192

BACON.

CHAPTER I.

BACON'S LIFE.

FRANCIS BACON was born at York House in the Strand, January 22, 1560-1. He was the youngest son of Sir Nicholas Bacon, Lord Keeper to Queen Elizabeth, by his second marriage with Anne, one of the daughters of Sir Anthony Cooke, of Giddy Hall, in the county of Essex, formerly tutor to Edward the Sixth. One of his mother's sisters had been married, also as second wife, to William Cecil, afterwards Lord Burghley. Thus, the subject of this volume was not only the son of one of Elizabeth's highest officers of state, but, through his mother, the nephew of the most influential and the most able of all her ministers. By his first marriage Sir Nicholas Bacon had a numerous family, but by the second marriage he had two sons only, Anthony and Francis. Anthony, the elder of the two, died at an early age in 1601, and, though he was mixed up a good deal with foreign affairs and seems to have been a man of energetic character, never attained to any great celebrity. Francis was a boy of sickly constitution, but he soon showed a special aptitude for learning, being doubtless encouraged and assisted therein by his mother, "a choice lady," as Rawley [1]

[1] Life of Bacon by his chaplain, William Rawley, prefixed to the *Resuscitatio*.

tells us, "and eminent for piety, virtue, and learning, being exquisitely skilled for a woman in the Greek and Latin tongues." According to the same authority, he was, as a child, specially noticed by the Queen, who would often, from his gravity and the maturity of his discourse beyond his years, term him "her young Lord Keeper." Being asked on one occasion how old he was, he answered "that he was two years younger than her Majesty's happy reign;" with which answer, we read, the Queen was much taken.

When only twelve years and three months old, in April, 1573, he entered Trinity College, Cambridge, residing in the same rooms with his elder brother, Anthony. At Christmas, 1575, he quitted the University, and in the following June was admitted, together with his brother, "de societate magistorum," that is probably as an *ancient*, at Gray's Inn.

It was during Bacon's residence, as a young boy, at Cambridge, that he was first struck with the idea of inaugurating a new method in the study of Nature. He told Rawley that he was only about sixteen years of age when he first fell into the dislike of the philosophy of Aristotle, "not for the worthlessness of the author, to whom he would ever ascribe all high attributes, but for the unfruitfulness of the way." "This," says Mr. Spedding, "ought to be regarded as the most important event of his life; the event which had a greater influence than any other upon his character and future course. From that moment there was awakened within his breast the appetite which cannot be satiated, and the passion which cannot commit excess. From that moment he had a vocation which employed and stimulated all the energies of his mind, gave a value to every vacant interval of time, an interest and significance to every random thought and casual accession of knowledge; an object to live for as wide as humanity, as immortal as the human race; an idea to live in vast and lofty

enough to fill the soul for ever with religious and heroic aspirations. From that moment, though still subject to interruptions, disappointments, errors, and regrets, he could never be without either work, or hope, or consolation." Other influences which Mr. Spedding supposes to have possessed Bacon's mind from the first were a zeal for the reformed religion, derived from his mother, and a feeling of intense loyalty and patriotism, derived from his father and the political surroundings amid which he found himself in his home.

In September, 1576, young Bacon was sent out to Paris with Sir Amias Paulet, who had just been appointed Ambassador to the Court of France. That country was then the theatre of stirring events, and Bacon had ample opportunities of witnessing the effects of misgovernment and civil dissensions. He visited several of the provinces, and seems to have made good use of his eyes and ears. In the spring of 1578-9, he returned to England, bearing with him a despatch from Sir Amias Paulet to the Queen, in which he was mentioned as "of great hope, endued with many good and singular parts," and one who, "if God gave him life, would prove a very able and sufficient subject to do her Highness good and acceptable service." Shortly before his return, and while he was still at Paris, he had one of those curious dreams which, if they harmonize with any subsequent event, are remembered all our lives, if not, are speedily forgotten. He dreamt that his father's house in the country was plastered all over with black mortar. About this very time his father was seized with a sudden illness, of which he soon afterwards died. It is said that Sir Nicholas Bacon had intended to purchase a large estate for his younger son, but the transaction had not been effected, and, when Francis returned to England, it was to find that his fortune was so insufficient, that he must at once turn to some remunerative employment. He naturally took

to the Bar, and spent the next few years in the quiet study of the law. On June 27, 1582, he was admitted an Utter Barrister of Gray's Inn, a position, however, which did not at that time confer the right to practise. In or about the following year he composed his first essay on the Instauration of Philosophy, to which he gave the name of *Temporis Partus Maximus*. At the age, therefore, at which most young men now leave the University, Bacon had already begun the great work of his life, the attack on the existing systems and methods of science, with a view to the advancement of man's knowledge and power.

In the Parliament which met in November, 1584, when the nation was in a white heat on the question of the maintenance of the Protestant religion and the Protestant succession, Bacon was returned to the House of Commons for the borough of Melcombe in Dorsetshire, having been also returned by Burghley for Gatton. In the next Parliament, which met in October, 1586, just after sentence had been passed by the Commissioners on Mary Queen of Scots, he sat for Taunton, and is mentioned by D'Ewes as one of the speakers, on the 4th of November, on the "Great Cause." Except the fact, however, that he spoke on the popular side, we know nothing of this speech. In the same year (1586), he became a bencher of Gray's Inn, and thus acquired the right to practise before the Courts at Westminster. At this time, therefore, when he was hardly twenty-six years of age, we may regard him as fairly started on his career, both as a lawyer and a politician.

In the Parliament which met on February 4, 1588-9, Bacon sat for Liverpool, and his rising importance is now attested by the frequent appearance of his name in the Journals. There is evidence to show that he was also employed in drawing State-papers. It was probably in the year 1591 that he first formed the acquaintance with Essex, which soon ripened into so

extraordinary an intimacy. Besides the common tastes and interests which bound them together, Bacon thought that he discovered in Essex the highest hopes of future service to his country. "I held at that time," he wrote fourteen years afterwards, "my Lord to be the fittest instrument to do good to the State; and therefore I applied myself to Him in a manner which I think happeneth rarely among men." That Bacon's friendship with Essex was a sincere one, whatever we may think of their subsequent relations, there can be no doubt. It was also about this time that, eager to obtain some position which would enable him freely to follow his favourite pursuits, he used, in a letter to Burghley, the celebrated expression, "I have taken all knowledge to be my province." The opportunity of leisure which he so earnestly coveted never came till the last few years of his life, and the best of the work which he did for science and letters was executed amidst the struggles or the duties of his professional career. Mr. Spedding conjectures that it was in January or February, 1592-3, that Bacon was encouraged to write *Observations on a Libel published this present year*, 1592, the libel being an invective against the Queen and Government, supposed to have been written by Father Parsons, the Jesuit. It was about this time also that he was elected knight of the shire for the County of Middlesex, in the Parliament which met on the 19th of February. In this Parliament he distinguished himself by his independence, heading the resistance of the Commons to a proposal of the Lords that they should take part in the deliberations on Supply, a resistance which required some courage on his part, as his powerful relation, the Lord Treasurer Burghley, was the spokesman of the Lords. He also demurred to the largely increased taxation which, in their fear of a foreign invasion, this Parliament imposed upon the people. Considering the absolute submission which the

Court then expected from its followers, we are hardly surprised to find that Bacon's conduct resulted in his exclusion from the Queen's presence. Her displeasure was, however, partly removed through the intervention of Essex, and, for some time, Bacon, whose private affairs were sadly in want of the relief which some lucrative appointment might afford him, fed himself on the hope,—vain as it turned out,—first of the post of Attorney, and then, when that was given to Coke, of Solicitor-General. His speeches on the Subsidy Bill could not be altogether forgiven, though Elizabeth, as was her wont, long encouraged the suits which, from the first probably, she had no intention of granting. Coke, too, when he became Attorney-General, probably used his influence against Bacon's appointment to the Solicitorship. At one time, sick with hope deferred, Bacon, writing to Essex, expresses his intention, "If her Majesty reject me, this to do. I will retire myself with a couple of men to Cambridge, and there spend my life in my studies and contemplations, without looking back." It might have been well, perhaps, for his own reputation and the cause of learning, had he carried out this project. We should never have heard of him as Lord Chancellor; but we should have been spared the many controversies with which our literature is still perplexed, as to the *morality* of his public life; and his "new instrument" for advancing the sciences, instead of being a fragment, would probably have been complete. But, though it was part of Elizabeth's plan to punish Bacon, she had by no means made up her mind to let her "watch-candle," as she used to call him, go quite out. Accordingly, by employing him on some state business, she contrived to shed on him one ray from the light of her countenance, just sufficient to retain him in her service, and to leave it open to herself to make future use of him, if it should ever so please her. During this time of waiting, his pecuniary

necessities were supplied by Anthony, who was always ready, without grudging or murmuring, not only to spend his own substance, but to contract debts for the sake of his younger brother. After the Solicitorship was definitely given to Serjeant Fleming, Essex presented him with a piece of land (which he doubtless mortgaged), and the Crown also granted him the lease of certain lands at Twickenham in reversion, so that he was probably able in some measure to satisfy the importunity of his creditors.

Bacon seems now to have betaken himself mainly to literary work. In 1597 appeared the *Essays* in their earliest shape, being only ten in number, and being bound up in the same volume (a small octavo) with the *Meditationes Sacræ* and the *Colours of Good and Evil* (or, as they are called in the original edition, *Places of Persuasion and Dissuasion*). To about the same period we ought probably to refer several of the *opuscula*, which were afterwards either incorporated into his philosophical works or laid by as incomplete. And, in the Christmas holidays of 1596, he presented the Queen with a specimen of a work which he purposed to write on *The Maxims of the Law*, as if by way of showing that he was not forgetting the claims on him of his own profession. This work was never finished.

If we except the active part which Bacon took in the legal reforms enacted by the Parliament of 1597, and his arrest for debt, while returning from an examination at the Tower, in 1598, nothing of sufficient importance in his life to be recounted in this brief biography took place between the publication of the *Essays* and the arraignment of Essex for High Treason in February, 1600-1. Into this unhappy subject, beyond the barest and briefest notice, it is not my intention or my province to enter. After the return of Essex, contrary to express orders, from his unsuccessful expedition into

Ireland, and his confinement on the suspicion of harbouring treasonable designs against the Government, Bacon, who had now for some time been restored to access, advised the Queen to make matters up with him privately, and "restore him to his former attendance, with some addition of honour to take away discontent." Already, however, in popular estimation he was supposed to be using his influence with the Queen not for but against his former patron, and in consequence he was exposed to the popular wrath, which, as Mr. Spedding says, "gathered with a fury proportioned to its ignorance." From that time to this it has been common to speak of Bacon's base ingratitude towards his friend and benefactor. If it be true, however, that, while unconscious of the real nature of Essex's plans, he had endeavoured to shield him and effect his reconciliation with the Queen, and had even incurred the Royal displeasure by doing so, but that, when convinced that the Earl had long been meditating overt acts of treason, of which indeed the mad and wicked attempt to raise the city no longer left any doubt, he felt his duty to the Throne and the peace and well-being of the country had claims on him superior to those of private friendship, I confess that I can see no sufficient reason for the persistent and bitter attacks upon his honour and character which it has been the fashion to make. And that this is the true history of the transaction, Mr. Spedding's narrative, I think, abundantly proves. We may deeply regret, as no doubt Bacon himself did, that circumstances forced him to take a part so hostile to his former friend, but as "one of her Majesty's Counsel Learned in the Law," at that time a very small body, and forming, as Mr. Spedding says, "a sort of legal body-guard" to the Queen, he had really no alternative, short of virtually declaring his own sympathy and complicity with treason, but to engage in the prosecution of Essex and Southampton. And, having

once engaged in the prosecution, it was clearly his duty to perform his task to the very best of his ability. We may well believe, as he tells us himself, that "he had spent more time in vain in studying how to make the Earl a good servant to the Queen and State, than he had done in anything else." And yet, when he had wholly and hopelessly failed in this effort, we can understand how, without any singular baseness or ingratitude, he might come to place his services unreservedly at the disposal of the Crown.

Essex was condemned, Bacon having undoubtedly taken a more effective part in the trial than did Coke, the Attorney-General, who, indeed, exhibited much incompetence. Before his execution, he confessed quite enough, and more than enough, to justify his sentence. But there was still much popular feeling on his side, and, hence, it was thought desirable that an authentic narrative of the conspiracy should be put forth by authority. Bacon was commanded by the Queen to prepare a draft of this document, but it was afterwards submitted to "certain principal Councillors," and "perused, weighed, censured, altered, and made almost a new writing, according to their Lordships' better consideration;" after which it was "exactly perused by the Queen herself, and some alterations made again by her appointment." The responsibility, therefore, for the *Declaration of the Practices and Treasons attempted and committed by Robert, late Earl of Essex*, in the form which it ultimately assumed, rests with the Queen and her Ministers, and not with Bacon, whose share in it was simply ministerial.

In the spring of 1601, Bacon lost his brother Anthony, with whom he had always lived on the most cordial and affectionate terms. On March 24, 1602-3, the last day of the old year according to the then reckoning, Elizabeth herself died, and was succeeded by James I. Bacon at once tendered

his services to the new king, and was continued "of the Learned Counsel in such manner as before he was to the Queen." He did not, however, receive any promotion, for as James, true to the prudent and wary character of his countrymen, expressed himself, "Every new king ought at least to let a year and a day pass before he make any innovation." Two days before the Coronation, Bacon received, with three hundred others, the cheap honour of knighthood, his wish that "the manner might be such as might grace him, since the matter will not," being thus disappointed. At this time he seems to have possessed considerable leisure, and to have devoted himself to reflecting and writing on his favourite idea, the interpretation of nature or the extension of the kingdom of man. Quite sincerely, I believe, in a letter to his cousin, Robert Cecil, he says: "My ambition now I shall only put upon my pen, whereby I shall be able to maintain memory and merit of the times succeeding." And the ambition was no mean one. For, in a paper written about this time, he proposes to himself no less a task than to "kindle a light in nature—a light which shall in its very rising touch and illuminate all the border-regions that confine upon the circle of our present knowledge; and so spreading further and further shall presently disclose and bring into sight all that is most hidden and secret in the world." The man who should succeed in accomplishing this work, he truly says, "would be the benefactor indeed of the human race, the propagator of man's empire over the universe, the champion of liberty, the conqueror and subduer of necessities." And why should he not be the man? For he believed that he "was born for the service of mankind," and he found by experience that he "was fitted for nothing so well as the study of Truth." He had indeed, at one time, "applied himself to acquire the arts of civil life," "hoping that, if he rose to any place of honour

in the State, he should have a larger command of industry and ability to help him in his work," and, moreover, that he "might get something done too for the good of men's souls;" but finding that "his zeal was mistaken for ambition, and that his life had already reached the turning-point," he "put all those thoughts aside, and" (in pursuance of his old determination) "betook himself wholly to this work." It was above all things important, if possible, to interest the king in his designs; and this he thought he could most effectually do by presenting him with a general survey and criticism of the existing stock of knowledge. Hence, probably, the origin of the two books of the *Proficience and Advancement of Learning*, the first of which was apparently written in 1603, though the work was not published till 1605.

But, though mainly engaged in attempting to carry out his grand design of subduing nature to the service of man, Bacon did not wholly withdraw from affairs of State. Thus, he presented the king with a *Discourse Touching the Happy Union of the Kingdoms of England and Scotland*, in which he insinuated that much might be left to time, as in the more perfect unions effected by nature, and again with *Considerations Touching the better Pacification and Edification of the Church of England*, in which he counselled a wide toleration of differences. He was, however, at this time little employed by the Court either in political or legal business.

In 1604 appeared the *Apology concerning the late Earl of Essex*, of the reception of which we have no information. Bacon seems to have taken a considerable share in the business of James' first parliament, to have been placed on many of the committees of the House of Commons, and sometimes to have acted as its spokesman, from all which circumstances we may infer his general popularity at that time. When the Commissioners for considering the union of the two king-

doms were appointed, his name was proposed first. He was also employed to draw up an analysis of all the questions that would have to be dealt with for the king's information, and, moreover, was entrusted, by his fellow-commissioners on the English side, with the charge of digesting the articles of the resolutions into their ultimate form. Notwithstanding, however, his parliamentary position, his reputation, and his connexions, he was again passed over for the Solicitorship, the reason not improbably being that he and Coke, who was then Attorney, could not work together. In 1606, being then in his forty-seventh year, he married Alice Barnham, an alderman's daughter, "an handsome maiden," and "to his liking." At his wedding, we read that he was "clad from top to toe in purple." Of his domestic life we hear nothing, and may therefore infer that it was peaceable, if not happy. On June 25, 1607, he was at last promoted to the Solicitor-Generalship, an office the value of which was then reckoned at about 1000*l.* a year. It was probably about this time that he finally settled the plan of the *Great Instauration*, and began to call it by that name. The *Cogitata et Visa*, which contains the substance of the first book of the *Novum Organum*, must have been composed as early as the summer or autumn of 1607, and, if we may accept literally what Rawley tells us of this latter work—namely, that he had himself seen at least twelve revisions of it, "revised year by year, one after another," we must fix the year 1608 as the time at which Bacon probably began to compose the *Novum Organum* itself. It will be seen, therefore, that his legal promotion in no way impaired his literary activity or his philosophical ardour. Writing to his friend Toby Matthew, and speaking of the *Great Instauration*, he says: "Of this I can assure you, that, though many things of great hope decay with youth (and multitude of civil businesses is wont to diminish the price,

. though not the delight, of contemplations), yet the proceeding in this work doth gain with me upon my affection and desire, both by years and businesses." In addition to his appointment to the Solicitorship, he, at this time, had a wind-fall from the death of Mylle, Clerk to the Star-Chamber, to the reversion of which place, valued at 2000*l.* a year, he had been appointed, through the interest of Burghley, as long ago as 1589. Bacon was now a wealthy man for those times, his annual income amounting, according to his own calculation, to over 4500*l.* a year, even when the interest on his debts was paid. About the end of 1609, came out the *De Sapientia Veterum,* one of his smallest, but one of his most finished works. Of the ideas which this work is intended to illustrate, I shall have to speak in the next chapter. The following year Bacon took a prominent part in the debates in Parliament on questions touching the royal prerogative, his attitude being usually a mediatory one. While never backward to join in urging particular grievances, he was always cautious not to attack the king's prerogative in theory, and hence he was selected as likely to be an acceptable spokesman, when their long list of gravamina was presented by the Commons to the king on the 7th of July. It would not, perhaps, be too much to say that Bacon had now become the leading member of the House of Commons, and that he was trusted both by the Court and by the popular party.

After ineffectual attempts at accommodation between the king and the Commons, Parliament was dissolved on February 29, 1610-11. During the period of repose which followed the dissolution, Bacon probably composed the new *Essays* which, together with the old ones corrected and enlarged, appeared in the edition of 1612. This was, by no means, the final form which the *Essays,* as known to us, assumed; for many further additions were made in the edition of 1625. But, as Mr.

Spedding says, "the character of the work was henceforth established, and its immortality secure." At this time also, he was again busy with the development of the *Great Instauration*. Early in 1611, he appears to have obtained directly from the king the promise of the Attorney-Generalship, when it should next fall vacant. It is curious that his powerful cousin, Robert Cecil, Earl of Salisbury, should rather have stood in the way of his preferment than have afforded him any assistance. Perhaps he suspected that his cousin would be a dangerous rival, if he should obtain too near access to the king. Salisbury died on the 24th May, 1612, and, though Bacon was unsuccessful in his efforts to succeed him as Principal Secretary of State, that is to say, as Prime Minister, he henceforth took an important position in the king's counsels, and, it must be acknowledged, spoke very freely of the policy of his late cousin. On October 28, 1613, he was appointed Attorney-General, several other legal promotions taking place at the same time in consequence of the death of Chief Justice Fleming. It is interesting to notice that one of Bacon's first cares in his new office was an attempt to put a stop to duelling, the practice of which among the upper classes had now become very frequent. In the new Parliament, which assembled in the spring of 1614, he was returned for three constituencies, but elected to sit for his old University of Cambridge. An objection was taken to this return, on the ground that, as Attorney-General, he was ineligible, and a committee was appointed to search for precedents. No precedent exactly to the point was found; for, though the last Attorney-General had sat in the last Parliament, he was not Attorney-General when elected. It was decided that, though the present Attorney-General should continue to sit in the present Parliament, no one holding the office should be eligible in future. Thus the objection, in all probability, arose not from any per-

sonal dislike of Bacon, but from the growing jealousy of the power of the Crown. It was, however, an evil omen, and this Parliament, after a short and stormy existence, was soon dissolved. That Bacon had any share in advising the dissolution seems to be improbable. He appears to have possessed the confidence of the House, and such an event as an angry parting between the king and the Commons was at variance with all that we know of his wishes and policy.

In 1615 occurred the examination and trial of Edmund Peacham, a Puritan clergyman, for High Treason. Bacon, with other ministers and law officers of the Crown, took part in examining him under torture and in attempting, previously to the trial, to obtain the opinion of the Judges on the chances of a conviction. Both practices are abhorrent to our modern notions of justice, but, if we except the fact that the opinion of the Judges was taken individually instead of as a body, there was nothing in the proceedings contrary to the usages or sentiments of those times, and the whole case owes its present celebrity to the fact that Bacon's name is connected with it.

In the spring of 1615-16, Lord Ellesmere being then dangerously ill, Bacon appears to have received a promise of the Chancellorship, but, subsequently, in reply to an application to be made at once a member of the Privy Council, the king seems to have given him his choice between the reversion of the Chancellorship and the immediate concession of his request. Bacon, eager to be in a position at once to give the king responsible advice, selected the less ambitious alternative, and was sworn in as a Councillor on June 9, 1616. About this time, as indeed often before, he was anxious to effect a codification of the laws, but, like so many efforts of the same kind since, his project was unfortunately doomed to disappointment. On March 6, 1616-17, Lord Ellesmere, who had long been

desirous of escaping from the cares of office, was allowed to resign the Great Seal, which was given, on the following day, to Bacon, with the title of Lord Keeper. The procession which attended him, two months afterwards, when he went to take his seat in the Court of Chancery, seems to have been an unusually large one. Besides his own servants, the Judges, and the Inns of Court, "he was accompanied by most of the nobility, with other gallants, to the number of more than 200 horse." The appointment was, no doubt, largely due to Villiers, who was now Earl of Buckingham and the prime favourite at Court. There soon, however, broke out a serious difference between the Lord Keeper and the favourite, on account of Bacon's opposition to a marriage between Villiers' brother and the daughter of Sir Edward Coke. The king, of course, took the side of his favourite, and it was only after many apologies and explanations that his displeasure, as well as that of Buckingham, was removed. Into these circumstances, and generally into the differences between Bacon and Coke, who were certainly by no means well affected towards each other, it is not necessary that, in so brief a biography as this, I should enter. It is enough to say that in his opposition to Coke, I believe Bacon, even where he may have been mistaken, to have been actuated by the belief that he was doing what was best for the interests of the king and the country. In politics he was by nature a Conservative, and was sincerely of opinion that it was desirable to maintain, in theory, the royal prerogative, though, in practice, he was always ready to stay or moderate its exercise.

On January 4, 1617-18, Bacon's title was raised from that of Lord Keeper to that of Lord Chancellor, and on the 12th of July following he was created Baron Verulam of Verulam. By the name of Lord Verulam, doubtless, and not by the vulgar misnomer of Lord Bacon, he expected to be known to posterity. As posterity, however, has insisted upon calling

him by his surname, it is best to speak of him as Francis Bacon, thus distinguishing him from his almost equally illustrious namesake, Roger Bacon, and avoiding the use of a title which he never bore.

The most important event of the year 1618 was the execution of Sir Walter Raleigh. Had it not been for the celebrity and accomplishments of the offender, and the strength of English antipathy to Spain, probably no one would have been found to question the justice of the sentence. To burn a town belonging to a friendly power, and massacre the inhabitants, is an act which, according to the usages of all civilized nations, can only be atoned for by the capital punishment of the principal offenders. But popular sympathy both at the time and subsequently has been with the culprit. Bacon, as one of the Council, advised the execution, and a large share in the responsibility attaching to the Declaration, by which the execution was afterwards justified, must no doubt be attributed to him. There is no evidence, however, that either in his advice or in his contribution to the Declaration he acted otherwise than as became the principal law officer of the Crown, or as any other conscientious person in his place, fully acquainted with all the circumstances of the case, would have acted.

On the 12th of October, 1620, the *Novum Organum,* the first instalment of the *Instauratio Magna,* at which Bacon had been working during so large a portion of his life and which was always the interest he had most at heart, was ready for distribution. In a private letter to the king, accompanying a present of the book, he says that he has "been about some such work near thirty years," and describes it as "no more but a new logic, teaching to invent and judge by induction, and thereby to make philosophy and science both more true and more active." He is "ambitious that, after these beginnings, and the wheel once set on going, men shall suck

more truth out of Christian pens than hitherto they have done out of heathen." The king replied in a most gracious letter, in which he expressed his resolution to read through the book with care and attention, "though I should steal some hours from my sleep; having otherwise as little spare time to read it as you had to write it." It was not only as a compliment that Bacon had presented a copy of the *Novum Organum* to the king. He hoped to interest him in the work of building up the sciences, and to obtain his aid in collecting from various quarters the materials on which the new method was to proceed. In acknowledging the king's letter, he says: "this comfortable beginning makes me hope further, that your Majesty will be aiding to me, in setting men on work for the collecting of a natural and experimental history; which is *basis totius negotii*." At this time he was at the zenith of his power and reputation. His greatest work had just been published, and, as a lawyer and statesman, he was evidently in high favour at Court, as well as, to all appearance, fairly popular throughout the country. On January 27, 1620-1, he was created Viscount St. Alban, "with all the ceremonies of robes and coronet." This he appears to have regarded as the summit of the dignities which he was likely to attain. "This is the eighth rise or reach, a diapason in music, ever a good number and accord for a close. And so I may without superstition be buried in St. Alban's habit or vestment."

The storm, however, which was to wreck the Chancellor's fortunes was now gathering. Parliament met on the 30th of January. At first, everything went on smoothly; but the attention of the House of Commons was soon directed to the question of Patents or Monopolies, one of the standing grievances of that time. The House, however, had no desire to quarrel with the king, and hence the attack was diverted from him to the Referees who had approved one of the most un-

popular of these patents, that of Sir Giles Monperson for Inns. The patent had been referred to two sets of Referees, one for matter in law, the other for the point of conveniency. Of the former set of Referees, Bacon was the principal, and it was soon evident that he was the person on whom the House, which was now under the leadership of Coke, was disposed to fix the responsibility of having given evil counsel to the king. But, before he had the opportunity of defending himself against any formal accusation as to his advice in the matter of monopolies, another and more serious charge was brought against him. The Committee of Grievances had already begun to turn their attention to the subject of abuses in the Courts of Justice, when, on the 14th of March, 1620-1, one Christopher Aubry presented a petition to the House charging the Chancellor with taking money, while a suit was still in progress. This petition was referred to the Committee, and was soon followed by another, either emanating from or based on the information of a disappointed suitor in a case of arbitration, who, though he had made Bacon a handsome present for the purpose of buying a suit of hangings for York House, had failed to obtain a decision in his favour. On the strength of these two cases, the Committee reported to the House that they had found matter for a charge of corruption against the Lord Chancellor. A few days afterwards, the Commons sent word to the Lords that they had "found abuses in certain eminent persons," and desired a conference. The result was that the Lords at once, and with great readiness, undertook to inquire into the case. They appointed three committees of four, with "power to take examinations of all points generally concerning this business." But, though the examination of witnesses was to take place in open court, the accused was apparently to have no power of cross-examination, or of excepting to the witnesses. Hence, as Mr. Spedding says, "we probably know the worst

of one side of the case, whatever obscurity may still rest upon it from the non-representation," except by Bacon's subsequent confession, "of the other." Almost immediately after the constitution of the Committees, new cases were sent up from the Commons, and it was soon apparent to Bacon that the sentence must go against him. The only question for him was how and how far he could procure a mitigation of the penalties. At first, he seems to have hoped to escape with a general submission and the resignation of the Great Seal, so avoiding the ignominy of a formal sentence. "If it be reformation that is sought," he says in a letter to the king, "the very taking away the seal, upon my general submission, will be as much in example for these four hundred years as any further severity." But the Lords were not in a frame of mind to be content either with a general submission or with the resignation of his office. Notwithstanding the evident wish of the prince and Buckingham that the House should accept Bacon's offer, it was resolved that the confession was not full enough, and must be framed so as to correspond with the particular charges. He was allowed, however, after a division, to reply by letter instead of in person. On the 30th of April, the "Confession and humble Submission of me, the Lord Chancellor," was delivered to the Lord Chief Justice, and read in the House. In this document, he says: "Descending into my own conscience, and calling my memory to account so far as I am able, I do plainly and ingenuously confess that I am guilty of corruption; and do renounce all defence, and put myself upon the grace and mercy of your Lordships." He then deals with the particular charges, twenty-eight in number, making, so far as we can judge, a full and candid statement of his exact degree of guilt in each case. Most of the presents had been received after the causes had been decided and without any antecedent promise, but some had undoubtedly

been made *pendente lite*. The latter might properly be regarded as bribes; the former, though not, properly speaking, bribes, savoured unpleasantly of corruption. There is undoubtedly a difference between making a present to a judge while a case is pending and after it has been determined, and, in the somewhat analogous case of elections to the House of Commons, our present law tolerates many practices after an election which would be deemed corrupt while the election is proceeding. But the practice of receiving presents from successful suitors, to say nothing of the advantage which it would give to the rich, would soon lead to express or tacit understandings between the judge and the parties to the suit, and so would come to be bribery in another and perhaps a more dangerous form. It is superfluous to say that any judge at the present day, who accepted a gift from a successful suitor after the termination of the suit, an almost incredible supposition, would, if discovered, never be permitted to execute his office again. But, in Bacon's time, the stream of English justice did not run so pure as it does now, and even the ethical theory generally prevalent on these subjects was probably very different from what it is amongst us. As he himself says, the taking of gifts by persons in high places was one of the abuses of the time, one of the *vitia temporis* rather than the *vitia hominis*. Bacon, of course, ought to have been superior to the temptation and to have set in his practice an example which, no doubt, his unbiassed intellect would have sternly dictated in theory. But, unfortunately, he was always in want of money. He seems never to have recovered from the embarrassment caused by the narrow circumstances in which he was accidentally left by his father, and his expenditure, including the interest on his loans, appears to have been almost invariably in excess of his income. This circumstance may explain, though it does not excuse, the weakness to which he yielded. That weakness,

even if we admit his own statement (and I can see no reason why we should not) that he had never allowed any bribe or reward to influence his decisions, I should not hesitate to call a crime. But at the same time I cannot but think that it is a crime for which, when we take into consideration the habits and sentiments of the age, posterity has exacted far too severe a penalty.

The Lords, of course, after Bacon's own confession, had no alternative but to find him guilty. The verdict was agreed to unanimously. But as to the sentence there was much difference of opinion. What may be called the Court party, including the prince and Buckingham, advocated the more lenient course, while what may be called the popular party was in favour of severity. The sentence at last agreed upon was that he should pay 40,000*l.* as fine and ransom, that he should be imprisoned in the Tower during the king's pleasure, that he should be for ever incapable of holding any office, place, or emolument in the State or Commonwealth, and that he should never sit again in Parliament or come within the verge of the Court. The Lord Admiral, that is, Buckingham, is alone entered as dissentient. The sentence was delivered with all due solemnity in presence of the Commons, but Bacon himself was absent on account of grievous sickness. However hard the sentence may have been in the particular instance, it at least had the good effect of stopping from that day forward all pecuniary transactions between judges and suitors.

Bacon's committal to the Tower was for a time deferred by his sickness, but, to satisfy the Lords, some of whom were beginning to be impatient for the execution of their sentence, he was actually imprisoned for about a couple of nights. The fine was never exacted, and indeed, being the first charge on his estate, served to protect him from other creditors. In accordance with that clause of the sentence which banished

him from the verge of the Court, he retired to Gorhambury on the 23rd of June. He was now at leisure, unwelcome as was the form in which that leisure had come, to devote himself to his favourite studies and to develope his cherished idea of an instauration of the sciences. And to this work he seems to have intended henceforth mainly to give his time, but, from the loss of official income, he was now sore pressed by pecuniary cares. In his embarrassment, he turned naturally and rightfully enough to the king, on whom he had many claims, and, probably by way of showing his readiness to undertake work which James would appreciate, he composed, during the Long Vacation of 1621, his History of Henry the Seventh. The king had already assigned his fine to trustees named by himself for his own benefit, but what Bacon required was some positive assistance. This, however, "the times being as they were," was not forthcoming, and the only help which could be obtained from the king was a warrant, dated November 14, 1622, recommending him to the favourable consideration of his creditors. In this document, the king, who "much commiserates the estate of the Lord of St. Alban," regrets that the times are not "such as we might free him at once by our liberality." The prohibition to come within the verge of the Court had been removed by royal warrant in the spring of this year, so that the only disabilities under which Bacon now laboured were his exclusion from Parliament and from office. It may be mentioned that a limited pardon, the important exception being that of the Parliamentary sentence, appears to have been sealed by the king in November, 1621. But the history of this pardon is attended with some obscurity.

After completing the History of Henry the Seventh, Bacon seems to have turned his attention to the preparation for the press, in an enlarged form and in a Latin version, of the

Advancement of Learning, which, under the new title of *De Augmentis Scientiarum*, appeared in October, 1623. This work was now designed to serve for the first part of the *Instauratio Magna*, as the *Novum Organum* served for the second. The translation into Latin seems to have been made by several hands, though under Bacon's own careful superintendence. On presenting a copy of the History of Henry the Seventh to the king, he offered to prepare a digest of the Laws of England, and about the same time he appears to have begun another work, with which, however, he did not make much way, the *Holy War*. This was to have been a discussion on the lawfulness and feasibility of a combined attack of the Christian powers on the Turk, an event which was at that time within the range of probabilities. Nor did Bacon's literary activity stop here. He was also busily engaged in preparing an instalment of a Natural and Experimental History, which was to supply the materials on which the inductive method was to work. For this part of his scheme he had invited assistance, but in vain, and hence, in the latter part of his life, he set to the task himself, complaining, however, that he was compelled to be a workman as well as an architect, having to "dig the clay and burn the brick" as well as to design and construct the building. That he spent so much time in making these collections of real or supposed facts of nature is much to be regretted; for they are far the least valuable part of his writings, though they may have been of service in setting an example to others and giving a direction to this kind of inquiry.

On the 20th of January, 1622-3, Bacon was brought by Buckingham to kiss the king's hand, and for a time there seemed to be a gleam of better fortune. It was even rumoured that he was to be made President of the Council, and he might possibly have been appointed to the Provostship of

Eton, for which he applied, had not the place been already promised. Meanwhile, his pecuniary difficulties continued, and he made an ineffectual attempt to dispose of Gorhambury to Buckingham. He also retired from Bedford House to his old lodgings in Gray's Inn, "for quiet and the better to hold out." Though not able to make his voice heard in Parliament, there can be no doubt that he heartily approved of breaking off the marriage treaty with Spain, the great event of the year 1623, and that he was one of those who were eager that the country should undertake a war for the recovery of the Palatinate.

On the 27th of March, 1625, James died, and Bacon might reasonably have hoped, at the beginning of a new reign and under a prince who had always showed himself favourably disposed to him, to receive at least a full pardon, if not some alleviation of his financial embarrassments. But the king and Buckingham soon found that they had troubles enough of their own, and apparently they lacked either the time, or the inclination, or the courage to lend a helping hand to their former adviser. In this year, the third and complete edition of the *Essays* was published, and the design of the *Great Instauration* was no doubt being filled in as rapidly as its author could write, the *Natural History* being now the part of it which mainly claimed his attention.

Though Bacon had long been in weak health, aggravated, probably, by his misfortunes, his end came suddenly and unexpectedly. One day, at the end of March, 1626, he was driving towards Highgate, when, there having been a fall of snow, the idea occurred to him to try whether snow would have the same effect as salt in arresting putrefaction. He alighted at a cottage, as the story goes, obtained a hen, and helped, with his own hands, to stuff it with snow. The experiment caused a sudden chill, which forced him to take refuge

at a house of Lord Arundel's lying on the road. His letter to Lord Arundel, excusing his having thus made a convenience of his house, betrays no apprehension of death, but the chill appears soon to have developed into what we should now call bronchitis, and Bacon died early in the morning of Easter Sunday, April 9, 1626.

We can hardly regard his death as premature. His life's work was finished. Even had he been recalled to office, it was now probably impossible for any man, however wise and patriotic, to heal the sores of the country without the intervention of a civil war. And the *Great Instauration* had been sufficiently sketched and exemplified to afford to coming generations most of the help that, in the then existing condition of science, it was likely to do. It is true that Bacon, had he lived longer, might have written more Essays or Histories, or executed a digest of the Laws, but, absorbed as he was in plans for the subjugation of Nature, it was hardly probable that he would employ his time on what he would regard as merely literary or legal pursuits.

In this slight sketch of Bacon's life, I have confined myself almost entirely to a bare statement of facts. My business is with the character, tendencies, and results of his philosophy, and not with the disputed passages of his life. But I cannot refrain from expressing an opinion that his memory has most unfortunately and unjustly suffered from the apparent contrast between his life and his works having so easily lent itself to the artifices of epigram. From Pope's famous couplet,[2] written

[2] "If parts allure thee, think how Bacon shined,
The wisest, brightest, meanest of mankind."
Essay on Man, Ep. iv.

Pope's next couplet,—

probably with little reflection and certainly with little knowledge, and from the rhetorical periods of Macaulay, which seem as if they had been written with Pope's lines ringing all the time in his ears, most Englishmen of this generation and the last seem to have been content to take on trust their estimate of one of the most illustrious of their countrymen and of mankind. Mr. Spedding has recently done much to remove these misapprehensions, and no one ought now to venture to pronounce an opinion on Bacon's character who has not at least acquainted himself with the shorter of Mr. Spedding's works.[3] On one count of the indictment, of course, judgment must, on his own confession, be entered against him, namely, that he was guilty of corruption in his office of Chancellor. But to be guilty of corruption and to be guilty of perversion of justice are two widely different things, likely as the one doubtless is to lead to the other. An apophthegm of Bacon's own, probably imparted in confidence to his intimate friends in his later years, may be taken, perhaps, as expressing the whole truth with regard to these sad transactions. "I was the justest judge that was in England these fifty years. But it was the justest censure in Parliament that was these two hundred years."

Carelessness about money, as already noticed, was probably the root from which all Bacon's errors and misfortunes sprang. And the want of money led him to seek preferment more

> "Or ravish'd with the whistling of a name,
> See Cromwell, damn'd to everlasting fame,"

has now lost its point. When Bacon's history and character are as well and as generally known as Cromwell's now are, posterity will perhaps be as little inclined to repeat with approbation the former couplet as the latter.

[3] *An Account of the Life and Times of Francis Bacon.* London, Trübner and Co., 1878.

openly and more keenly than we, in these days, when we are more given to mask our ambitions, should regard as consistent with dignity. But he was anything rather than "mean." On the other hand, he was generous, open-hearted, affectionate, peculiarly sensitive to kindnesses, and equally forgetful of injuries. The epithet of "great," which has been so ungrudgingly accorded to him as a writer, might, without any singular impropriety, be applied to him also as a man. The story of his life, it must be confessed, is not altogether what the reader of his works would have desired, but the contrast has been so exaggerated as to amount to a serious and injurious misrepresentation.

CHAPTER II.

BACON'S WORKS.

BACON'S Works may be divided into three classes, the Philosophical Works, which form far the largest portion, the Literary Works, and the Professional Works. Many of these are mere fragments or short essays, afterwards thrown aside and replaced by other essays, also unfinished, or by the larger and more complete works as known to the general reader. All that remains of Bacon's writings, however brief or fragmentary, has been collected in Ellis and Spedding's Edition, and sometimes, as in the elaboration of his new logical method or *Novum Organum*, it is interesting to trace the history of an idea through several successive papers written at different periods of his life. But, in attempting a general account of Bacon's literary activity, which is all that I aim at in the present chapter, to enumerate all his various writings, much more to endeavour to determine their mutual relations, would be merely to tax the patience of the reader to no purpose. I shall, therefore, for the most part, confine myself to noticing the more important and matured works, only mentioning the slighter or more unfinished writings where something of special interest attaches to them.

The principal and best known of the philosophical works are the *Advancement of Learning*, which was published in English in 1605, the *Novum Organum*, which was pub-

lished in Latin in 1620, and the *De Augmentis Scientiarum* which was published in Latin in 1623. The last of these works may be regarded as a much enlarged edition of the first, though *The Twoo Bookes of Francis Bacon of the Proficience and Advancement of Learning Divine and Humane* have a certain advantage over their larger and more pretentious rival from being presented in a more compendious form and in the noble and flowing periods of their author's English instead of in a foreign tongue or a translation. James the First had ascended the throne of England in 1603, and Bacon, who was anxious to stand well with him as well as to interest him in his schemes for the reformation of science, appears to have hurried on the composition of the *Advancement of Learning* for the purpose of making an "oblation," as he calls it, to the new king. Hence the marks of haste and incompleteness which may be detected in the Second Book, that which treats of the deficiencies to be supplied in the present stock of knowledge. In the *De Augmentis* this one book was expanded into no less than eight. The first book is far more finished in style, and more complete in matter. It seems to have been written in the year 1603, immediately after James' accession, and treats of the dignity of learning and "the excellency of the merit and true glory in the augmentation and propagation thereof." A prince, who was himself learned and interested in learning, might, so Bacon thought, do much to help in the accumulation of those materials and the provision of that co-operation which were necessary to the renovation of the sciences. But James was himself too much embarrassed in his finances during the greater part of his reign, to become a second Alexander, had he even believed sufficiently in Bacon's design to be willing to assume that character.

When Bacon wrote the *Advancement of Learning*, he does

not seem to have had any idea of constituting it a part of the *Great Instauration*, but, as time went on, he appears to have thought that the attempt to build up a new philosophy might fittingly be preceded by a review of the present state of knowledge. Hence, in the *Distributio Operis*, which is prefixed to the *Novum Organum*, the first place in the *Great Instauration* is assigned to what he calls "Partitiones Scientiarum," or "a summary or general description of the knowledge which the human race at present possesses," including, however, "not only things already invented and known, but likewise things omitted which ought to be there." Thus, the *De Augmentis*, or expanded edition of the *Advancement of Learning*, instead of being a mere preparatory tract, was designed to become an integral part of the great work. And, though Bacon's weak health, lack of opportunity, and personal misfortunes prevented him from executing his plan on the proportions which he had prescribed to himself, the book, even as it stands, must have had few readers who have not thought it worthy of the position which its author intended for it.

Whether the additional matter was originally written in English or Latin, we do not know, but it is said, on the authority of Archbishop Tenison, that George Herbert, the poet, was one of the translators employed to convert the *Advancement of Learning* into Latin. The work was, however, carefully superintended by Bacon himself. "Proprio marte plurimum desudavit," as Dr. Rawley tells us. He had applied, some years before, for the assistance of one Dr. Playfer, of Cambridge, who, according to Tenison, sent him a specimen of his workmanship, but "of such superfine Latinity, that the Lord Bacon did not encourage him to labour further in that work, in the penning of which he desired not so much neat and polite, as clear, masculine and apt expression." The first

English translation of this work was executed by Dr. Gilbert Wats or Watts of Oxford. It was severely criticized by Bacon's friends, and has since been replaced by others. To the student not sufficiently acquainted with Latin to read the original, the most serviceable version will now be found in the Fourth Volume of Ellis and Spedding's Edition of Bacon's Works.

The remaining parts of the *Great Instauration*, as enumerated in the *Distributio Operis* or Plan of the Work, are:— (2) the "*Novum Organum*, or Indications Concerning the Interpretation of Nature;" (3) "*Phœnomena Universi*, or a Natural and Experimental History for the Construction of Philosophy;" (4) "*Scala Intellectus*, the Ladder of the Intellect;" (5) "*Prodromi*, the Forerunners, or Anticipations of the New Philosophy;" (6) "*Philosophia Secunda*, or Active Science."

The second part, or the proper method of interpreting Nature, was evidently the one (if we except the sixth, which was to be the crown of the whole design and the gradual work of posterity) to which Bacon attached the greatest importance. It is mainly represented in the *Novum Organum*, though preliminary drafts of portions of this work, often curiously differing from it in detail, are to be found in parts of the *Valerius Terminus*, and in the *Partis Secundæ Delineatio*, the *Cogitata et Visa*, the *Temporis Partus Masculus*, and the *Filum Labyrinthi sive Inquisitio Legitima de Motu*, to say nothing of smaller pieces. Of these preliminary drafts of the *Novum Organum*, far the most interesting is the *Cogitata et Visa*, containing the substance of the First Book of the *Novum Organum*, and composed probably in the summer or autumn of 1607. A very beautiful manuscript of it, carefully corrected in Bacon's own handwriting, exists in the Library of Queen's College, Oxford, but the first printed edition, published, along with other minor works, by Isaac Gruter in 1653,

is taken from another copy, now no longer extant. The composition of the *Novum Organum* itself appears to have been begun about 1608. For the first edition appeared in 1620, and Dr. Rawley (in the Life of Bacon, prefixed to the *Resuscitatio*) tells us that he had himself seen at least twelve copies of the work, "revised year by year, one after another; and every year altered and amended in the frame thereof." This extreme care expended on its elaboration is apparent principally in the aphorisms of the First Book, which, in point of pithiness and incisiveness of language, it would be difficult to surpass. When the first edition (which, by the way, is a very handsome folio volume) appeared, it was preceded by the piece beginning, "Franciscus de Verulamio sic cogitavit," a Dedication to the King, a Preface to the *Instauratio Magna* (of which, though only the second part, it was the first instalment), the Distributio Operis (that is, the plan of the whole *Instauration*), and a Preface peculiar to itself. It was followed by a small tract, entitled *Parasceue ad Historiam Naturalem et Experimentalem*, a Preparation to a Natural and Experimental History, printed, by anticipation, as a sort of specimen, or, possibly, *résumé* of the last part but one of the *Novum Organum*, promised in book ii. ch. 21. Finally, the volume is closed by a *Catalogus Historiarum Particularium secundum Capita*, or List of Desiderata in the specific Materials for Induction.

The *Novum Organum*, in the shape in which its author left it, is only a fragment, though a very considerable fragment, of the larger work which Bacon contemplated under that title, as adequately representing the second part of the *Great Instauration*. The enumeration of the parts wanting will be found in book ii. aph. 21. Nevertheless, though only a fragment, the *Novum Organum*, and especially the First Book, is the most carefully written of all Bacon's philosophical works. Moreover, as describing the new method of

which the renovation of knowledge was to be the result, it is the keystone of the entire system.

The Third Part of the *Great Instauration*, the *Phænomena Universi*, was to contain a collection of arranged and sifted materials on which the method of induction was to work. Of this part, even according to Bacon's limited conception of the extent and variety of nature, we have only a very small portion, and, according to a juster estimate of the boundless extent of the "Phænomena Universi," that portion might almost be described as infinitesimal. Such as it is, however, it is contained mainly in the *Historia Ventorum*, the *Historia Vitæ et Mortis*, the *Historia Densi et Rari*, and the *Sylva Sylvarum*. The first of these works, an attempt to collect and digest various facts in connexion with the winds, was published in November, 1622. It was to be followed at monthly intervals by other tracts containing similar collections, and the volume in which it was published comprises introductions to five other "histories," namely those of "the dense and the rare," "the heavy and the light," "the sympathies and antipathies of things," "sulphur, mercury, and salt," "life and death." Bacon's promise was only very inadequately fulfilled. The *Historia Vitæ et Mortis* was published about the end of January, 1622-3. The *Historia Densi et Rari* did not appear during Bacon's lifetime, and was first published in Dr. Rawley's *Opuscula Varia Posthuma*, in 1658. The three others were never composed in the form of separate treatises, though the subjects of which they were to treat occupy several sections of the *Sylva Sylvarum*. There are extant short or imperfect drafts of other treatises of the same kind, such as those on Sound, Light, the Magnet, &c.

The last work on which Bacon was engaged was the *Sylva Sylvarum*,[1] a miscellaneous collection of observations

[1] The name *Sylva Sylvarum* probably means, as Mr. Spedding suggests, a collection of collections. Mr. Ellis, on the other hand, takes it as a

and experiments in Natural History. It was published by Dr. Rawley in 1627, the year after Bacon's death, but the preface was written by Rawley during his lifetime. This preface is of considerable interest, both as showing Bacon's conception of what a Natural History ought to be (he was fully conscious, it may be noticed, how far short his own performance came of his ideal), and as offering some excuse for what must be acknowledged to be the very crude and fanciful character of many of the "experiments" recorded in the work. "I have heard his lordship often say, that, if he should have served the glory of his own name, he had better not to have published this Natural History: for it may seem an indigested heap of particulars, and cannot have that lustre which books cast into methods have; but that he resolved to prefer the good of men, and that which might best secure it, before anything that might have relation to himself." "And I have heard his lordship speak complainingly, that his lordship (who thinketh he deserveth to be an architect in this building) should be forced to be a workman and a labourer, and to dig the clay and burn the bricks: and more than that, according to the hard condition of the Israelites at the latter end, to gather the straw and stubble over all the fields to burn the bricks withal. For he knoweth that, except he do it, nothing will be done; men are so set to despise the means of their own good." This book has furnished Bacon's critics, especially his German critics, Lasson and Liebig, with some of their most telling shafts. And to men of our generation nothing, it must be owned, can be more transparently absurd than such conceits as that "the blood-stone is good for them that bleed at the nose;" than the "report" of "the writers of natural magic" that "the heart of an ape, worn near the heart,

Hebraism for *optima sylva*, "sylva being used, as ὕλη in Greek, for the materials out of which anything is to be constructed."

comforteth the heart and increaseth audacity," "and that the same heart likewise of an ape, applied to the neck or head, helpeth the wit, and is good for the falling sickness;" than the statement that "there be divers sorts of bracelets fit to comfort the spirits, and they be of three intentions, refrigerant, corroborant, and aperient;" than the suggestion to "try the force of imagination upon staying the working of beer when the barm is put in, or upon the coming of butter or cheese, after the churning, or the rennet be put in;" than the notion that water is congealed into crystals, or that the moon influences terrestrial objects in four ways, by "drawing forth of heat," by "inducing of putrefaction," by "increase of moisture," and by "exciting of the motions of spirits."[2] But in reply to any argument based upon the occurrence in Bacon's writings of absurdities of this kind, which might be largely multiplied, it may be pleaded that these were the fancies of his age, from which probably no man of that time was altogether free. Amongst the early revivers of science, there seems to have been a peculiarly keen appetite for the marvellous. "In Bacon's time," as Mr Ellis says, "and still more at an earlier period, men delighted in nothing more than in collections of remarkable facts; the more marvellous, so they did not become altogether incredible, the better." And we have only to look into books like Sir Thomas Browne's *Vulgar and Common Errors*, or the various works of Joseph Glanville, to see how persistent such notions were even in the generation after Bacon's death. Moreover, a large number of these fancies may be grouped under the heads of "sympathy and antipathy," "force of imagination," &c., subjects on which peculiarly obscure ideas prevailed at this time. Lastly, defective and often ridiculous as this book is from our point of view, it is, if we refer it to

[2] See Experiments 967, 978, 961, 992, 364, 890—897.

its place in the history of science, very far from being contemptible. It is probably the best and most complete single collection of the kind that, up to that time, had been published.

Appended to the *Sylva Sylvarum* in Rawley's edition is the *New Atlantis*. This is deservedly one of the most popular of Bacon's works; it bears the stamp of his genius as much, perhaps, as anything which he wrote; and, lastly, it is credited, and I conceive justly so, with having, to a large extent, suggested the foundation and programme of our own Royal Society, if not of several foreign scientific associations as well. Its relation to the *Sylva Sylvarum* cannot be better described than in the language of Mr. Spedding:—"The *New Atlantis* seems to have been written in 1624, and, though not finished, to have been intended for publication as it stands. It was published accordingly by Dr. Rawley in 1627, at the end of the volume containing the *Sylva Sylvarum;* for which place Bacon had himself designed it, the subjects of the two being so near akin; the one representing his idea of what should be the end of the work which in the other he supposed himself to be beginning. For the story of Solomon's House is nothing more than a vision of the practical results which he anticipated from the study of natural history diligently and systematically carried on through successive generations." No student of Bacon or of scientific literature should omit to read this charming romance. It teems with hope and suggestion, and now, after an interval of more than two centuries and a half, a strange interest attaches to a comparison of the "Riches of Solomon's House" with the inventions which have actually been accomplished since Bacon's time, or which, with our enlarged knowledge of what is possible, we may not unreasonably expect in the future.

Amongst the *Impetus Philosophici* which occupy the

latter part of Gruter's volume are two small pieces entitled *Scala Intellectus sive Filum Labyrinthi*, the Ladder of the Intellect or Thread of the Labyrinth, and *Prodromi sive Anticipationes Philosophiæ Secundæ*, Forerunners or Anticipations of the Second Philosophy. These were intended as Prefaces to the fourth and fifth parts of the *Instauratio* respectively. Whether anything more relating to those parts is extant seems doubtful.

"The sixth part of my work (to which the rest is simply ministerial) at length discloses and sets forth that body of philosophy itself which is developed and established by a legitimate, chaste, and severe course of inquiry such as has already been propounded. The completion, however, of this last part is a thing both above my strength and beyond my hopes. I expect to make a beginning of the work—a beginning, as I hope, not to be despised: the fortunes of the human race will give the issue—an issue, it may be, such as, in the present condition of things and of the minds of men, cannot easily be grasped or imagined. For the matter in hand is no mere felicity of speculation, but the real business and fortunes of the human race, and all power of operation." But, though Bacon hoped himself fittingly to inaugurate the work, we search in vain amongst his writings for any special treatise which can be referred to this head. Nor is this fact without its explanation. The *Scientia Activa* was to depend on the knowledge of "Forms," but how far Bacon was from having attained to a knowledge of "Forms," and how vague was the conception which he often attached to this term, will be only too familiar to the attentive student of the *Novum Organum*. The story which he applies to the Alchemists[3] of the old man who bequeathed to his sons a piece of gold hidden in a vineyard applies also, in no small measure, to himself.

[3] *Nov. Org.*, i. 85.

He did not discover "Forms," but he did what was of far more value to posterity; he recalled men to the observation of facts, gave an impulse to the study of nature, and, if not the founder of the Inductive Method, at least contributed more than any other man to its wider, more correct, and more fruitful employment.

Of Bacon's literary, as distinct from his philosophical and professional, works, far the most popular and important are the *Essays*. These, in their earliest shape, formed part of a very small octavo volume, published in 1597, and were only ten in number. They were entitled: 1, Of Studie; 2, Of Discourse; 3, Of Ceremonies and Respects; 4, Of Followers and Friends; 5, Sutors (i. e. Suitors); 6, Of Expence; 7, Of Regiment of Health; 8, Of Honour and Reputation; 9, Of Faction; 10, Of Negotiating. All are very brief and condensed, and they are entirely devoid of illustration or ornament. In this shape, they were reprinted in 1598, 1604, and 1606. In 1612, a new edition was brought out, with many alterations and additions. This edition contained forty essays. Finally, the book in its present form, and containing fifty-eight essays, was published in 1625, the year before Bacon's death. This greatly enlarged edition, which is entitled, "*The Essayes or Counsels, Civill and Morall,* of Francis Lo. Verulam, Viscount St. Alban, Newly Enlarged," may be regarded as a storehouse of the practical wisdom gathered during its author's lifetime, a life singularly rich in opportunities for such accumulations.

The title of *Essays* is probably taken from the *Essais* of Montaigne,[4] which first appeared at Bordeaux in 1580. Hallam says of these that they are the first writings in the French language "which a gentleman is ashamed not to have

[4] Montaigne is quoted by name in the first Essay.

read." A similar remark, if we confine ourselves to prose works, might be made of Bacon's *Essays*. They still retain their ground as classics, and, some time or other during his life, every educated Englishman is certain to read them. Perhaps also, excepting Shakespeare's plays, they furnish more quotations than any other work in the language. To attempt to describe the characteristics of a book so familiar would be no compliment to the reader. But it may not be superfluous to remark that the *Essays* are the most original of all Bacon's works, those which, in detail, he seems to have thought out most completely for himself, apart from books and collections of common-places. The last edition teems, indeed, with quotations and illustrations, but they are suggested by his own matter and do not suggest it. Though the *Essays* have the same title as the larger collection of Montaigne, the two works have little in common, except their rare power of exciting interest and the unmistakable mark of genius which is impressed on them both. On a few subjects, such as on Death, Friendship, Glory, Anger, Greatness, we are able to compare the two authors, when treating the same topics, but, for the most part, their paths are divergent. Bacon's reflections are more connected and condensed, and his style more weighty, then those of his French prototype. On the other hand, Montaigne is undoubtedly the more entertaining. Both authors seem to be thoroughly conversant with books, though the quotations and allusions of Montaigne seem to come to him more naturally than those of Bacon. The Englishman seems to know more of affairs; the Frenchman of life. Those curious in literary history can also compare with the *Essays* the treatise *De la Sagesse*, by Pierre Charron, first published in 1601, and the *Prince* (Il Principe) of Machiavelli, which, having appeared so far back as 1532, was already a well-known and standard book, when Bacon began the com-

position of the *Essays*. That Bacon was intimately acquainted with the *Prince* as, I suppose, were all educated statesmen of his time, there can be no doubt, but I cannot accede to the view, apparently entertained by Dr. Abbott, that Bacon derived his opinions on polity, much less on morality, from Machiavelli. Waiving the questions as to the precise motives and the true interpretation of the maxims of Machiavelli, nothing can well be more remote either from what is ordinarily understood by Machiavellism, or from some of the actual utterances of Machiavelli himself, when taken in their literal sense, than such passages as the following, expressing, as I believe, Bacon's genuine sentiments: "I take Goodness in this sense, the affecting of the weal of men, which is that the Grecians call Philanthropia. This of all virtues and dignities of the mind is the greatest; being the character of the Deity: and without it man is a busy, mischievous, wretched thing; no better than a kind of vermin." . . . . "The inclination to goodness is imprinted deeply in the nature of man; insomuch that if it issue not towards men, it will take unto other living creatures; as it is seen in the Turks, a cruel people, who nevertheless are kind to beasts, and give alms to dogs and birds." . . . . "The parts and signs of goodness are many. If a man be gracious and courteous to strangers, it shows he is a citizen of the world, and that his heart is no island cut off from other lands, but a continent that joins to them. If he be compassionate towards the afflictions of others, it shows that his heart is like the noble tree that is wounded itself when it gives the balm. If he easily pardons and remits offences, it shows that his mind is planted above injuries; so that he cannot be shot. If he be thankful for small benefits, it shows that he weighs men's minds, and not their trash. But above all, if he have St. Paul's perfection, that he would wish to be an anathema from Christ for the

salvation of his brethren, it shows much of a divine nature, and a kind of conformity with Christ himself!" [5] And again: "He that seeketh to be eminent amongst able men hath a great task; but that is ever good for the public. But he that plots to be the only figure amongst ciphers is the decay of a whole age. Honour hath three things in it: the vantage ground to do good; the approach to kings and principal persons; and the raising of a man's own fortunes. He that hath the best of these intentions, when he aspireth, is an honest man; and that prince that can discern of these intentions in another that aspireth, is a wise prince. Generally, let princes and states choose such ministers as are more sensible of duty than of rising; and such as have business rather upon conscience than upon bravery [that is, vain glory or ostentation]; and let them discern a busy nature from a willing mind?" [6] Even in the Essay on "Wisdom for a Man's Self" (Essay 23), where, if anywhere, we should expect to find the influence of Machiavelli's teaching, had Bacon been so apt a disciple as Dr. Abbott supposes, what actually occur are such expressions as these: "Wisdom for a man's self is, in many branches thereof, a depraved thing. It is the wisdom of rats, that will be sure to leave a house somewhat before it falls. It is the wisdom of the fox, that thrusts out the badger, who digged and made room for him. It is the wisdom of crocodiles, that shed tears when they would devour." . . . . "An ant is a wise creature for itself, but it is a shrewd thing in an orchard or garden. And certainly men that are great lovers of themselves waste the public. Divide with reason between self-love and society; and be so true to thyself as thou be not false to others, especially to thy king and country. It is a poor centre of a man's actions, *himself*.

[5] Essay 13. Of Goodness, and Goodness of Nature.
[6] Essay 36. Of Ambition.

It is right earth. For that only stands fast upon its own centre; whereas all things that have affinity with the heavens move upon the centre of another, which they benefit!" Still more alien from a morality of mere self-seeking is the spirit of some of the passages in the *De Augmentis*. Take, for instance, the following: "If a man's mind be truly inflamed with charity, it raises him to greater perfection than all the doctrines of morality can do; which is but a sophist in comparison with the other. Nay further, as Xenophon truly observed, 'that all other affections though they raise the mind, yet they distort and disorder it by their ecstasies and excesses, but only love at the same time exalts and composes it;' so all the other qualities which we admire in man, though they advance nature, are yet subject to excess; whereas charity alone admits of no excess. The Angels, aspiring to be like God in power, transgressed and fell: 'I will ascend, and be like unto the Most High.' Man, aspiring to be like God in knowledge, transgressed and fell: 'Ye shall be as gods, knowing good and evil.' But by aspiring to a similitude of God in goodness or love, neither angel or man ever transgressed or shall transgress; for unto that imitation we are called, 'Love your enemies, bless them which hate you, and pray for them that despitefully use you and persecute you.' So in the first platform of the divine nature itself, the heathen religion speaks thus, 'Optimus Maximus,' but the Sacred Scriptures thus, 'His mercy is over all his works.'" [7]

It may indeed be said that, both in the *Essays* and elsewhere, there are many maxims teaching the art of self-advancement or of becoming, as Bacon phrases it, the Architect of Fortune. And why should there not be? It is only a common-place to say that the general good is, as a rule, best promoted by each man seeking his own individual good. A world, if we can

[7] *De Augmentis*, book vii. ch. 3.

conceive such a world, in which this was not the case, would present but a very poor parody even of the amount of happiness which is attainable under present circumstances. And, if this be so, why should not a moralist give rules for bettering one's own fortunes, providing, at least, that such rules are not likely to interfere with the general welfare? There are many instances, undoubtedly, where a man ought to postpone his own interests to the good of his family, or of his neighbours, or of his country, or of mankind at large, and, unless men were in the habit of submitting, on occasion, to these acts of self-sacrifice, no society could long exist. But is Bacon less ready to acknowledge or to insist upon the importance of this fact than the great mass of writers on ethical questions? His place is, surely, not with the small class of moralists, who, like Machiavelli, Hobbes, and Mandeville, appeal only, or mainly, to the selfish instincts of mankind, or to the reflections of a cool self-love, but with that far larger class who recognize benevolent principles of action as co-ordinate with and often controlling those which merely regard ourselves. In the book where he most expressly treats the subject (*De Augm.* book vii.), he distinguishes between "Individual or Self-Good" and the "Good of Communion," the "two natures of good an appetite towards which is formed and imprinted on everything," and he insists as emphatically as he can do on the superiority of the latter as the "more general form which controls and keeps in order the lesser appetites and inclinations." "It is much more happy," he presently goes on to say, "to fail in good and virtuous ends for the public, than to obtain all that we can wish to ourselves in our private fortune." And even where[8] he notes as deficient ("not but that it is used and practised even more than is fit, but it has not been handled in books") that part of knowledge which he calls the "Architect

[8] *De Augmentis*, book viii. ch. 2.

of Fortune," he adds the warning: "Not, however, that learning admires or esteems this architecture of fortune otherwise than as an inferior work. For no man's fortune can be an end worthy of the gift of being that has been given him by God; and often the worthiest men abandon their fortunes willingly, that they may have leisure for higher pursuits." Lastly, though he often cites Machiavelli, and deservedly, as I conceive, praises him for the excellence of his work within certain limits, he does not fail to speak of his "evil arts," and to condemn specifically such positions as these,—that men can only be wrought upon by fear, and that therefore a politic man should contrive to have every man surrounded by perils, or this "that virtue itself a man should not trouble himself to attain, but only the appearance thereof to the world, because the credit and reputation of virtue is a help, but the use of it an impediment."

I have taken some pains to argue against Dr. Abbott's position, because I think it gives a wholly false idea of Bacon's attitude towards practical philosophy and the conduct of life, and I have selected this place, rather than the chapter on Bacon's philosophical opinions, for the criticism, because Dr. Abbott's remarks occur in his Introduction to the *Essays*, and are therefore most conveniently noticed, while speaking of that work.

The literary production which, during Bacon's life-time and for many years afterwards, ranked next in popularity and was regarded as next in importance to the *Essays*, was undoubtedly the *De Sapientia Veterum*, the treatise on the Wisdom of the Ancients. This was first published, in a small duodecimo volume, in 1609. It has frequently been republished, and early translations of it exist in English and Italian. The plan of the work is to recite certain classical fables, or, as we should now call them, myths, disclosing, as it proceeds, the moral

and physical lessons which are supposed to lie latent in them. The hypothesis on which the interpretations rest would fall in with the usual mode of thinking in the seventeenth century, and then, and even later, would doubtless find many adherents amongst the most learned and judicious men of the time; now it would hardly meet with a single believer, even amongst men of ordinary education. It is that, prior to the time of Homer, Hesiod, and the earliest extant Greek writers, there existed a period of high intellectual cultivation, in which the fables had been invented for the purpose of setting forth, in allegory, certain important truths, known to the ancient world, concerning nature and man. "Had they been certainly the production of that age," the age of Homer, Hesiod, and the rest, "and of those authors by whose report they have come down to us, I should not have thought of looking for anything great or lofty from such a source. But it will appear upon our attentive examination that they are delivered not as new inventions then first published, but as stories already received and believed. Moreover, since they are told in different ways by writers nearly contemporaneous, it is easy to see that what all the versions have in common came from ancient tradition, while the parts in which they vary are the additions introduced by the several writers for embellishment—a circumstance which gives them in my eyes a much higher value: for so they must be regarded as neither being the inventions nor belonging to the age of the poets themselves, but as sacred relics and gentle breezes blowing from better times, that were caught from the traditions of more ancient nations, and so received into the flutes and pipes of the Greeks."[9] To the student of the *Novum Organum* this way of thinking will be familiar. There Bacon constantly disparages the later Greeks,

[9] Preface to the *De Sapientia Veterum*. Mr. Spedding's translation, slightly altered.

speaking, for instance, of Aristotle and Plato as the lighter planks, which had been floated down by the river of time, while the heavier and more solid materials of the older philosophies had sunk to the bottom.[1] This idea of a primeval wisdom which underlay the extant remains of antiquity was, as Mr. Spedding points out, by no means an unnatural or incredible fancy in Bacon's days. "When a new continent was first discovered, in which the savage inhabitants were found laden with golden ornaments, it was easy to believe in the rumours of El Dorado; and when the buried fragments of Greek and Roman civilization were first brought up for the examination of a new age, they might easily suggest to the imaginative a world of wonders still unrecovered." The dream has, of course, been entirely dissipated in recent times by the greatly improved methods of studying early history and early institutions, as well as by the new sciences of Comparative Mythology and Comparative Philology. An irresistible consensus of evidence now shows that the march of civilization has been onwards and not backwards; that man has not fallen from the heights, but risen from the depths. And wherever we may look for the origin of the myths, whether in a "disease of language," or in the distorted stories of dead heroes and rival races, we no longer have any faith that we shall find in them a "hidden wisdom" unknown to later generations.

Bacon's conception of the meaning of the classical fables, and the kind of interest which still attaches to the *De Sapientia Veterum*, will best appear, if I give some examples of his treatment. I have selected two, one conveying a moral, the other a physical lesson.

NARCISSUS;

OR SELF-LOVE.

"Narcissus is said to have been a young man of wonderful

[1] *Nov Org.*, book i. aphs. 71, 77.

beauty, but intolerably proud, fastidious, and disdainful. Pleased with himself and despising all others, he led a solitary life in the woods and hunting-grounds; with a few companions to whom he was all in all; followed also, wherever he went, by a nymph called Echo. Living thus, he came by chance one day to a clear fountain, and (being in the heat of noon) lay down by it; when, beholding in the water his own image, he fell into such a study, and then into such a rapturous admiration of himself, that he could not be drawn away from gazing at the shadowy picture, but remained rooted on the spot till sense left him, and at last he was changed into the flower that bears his name; a flower which appears in the early spring, and is sacred to the infernal deities,—Pluto, Proserpine, and the Furies.

"In this fable are represented the dispositions, and the fortunes too, of those persons who from consciousness either of beauty or some other gift with which nature unaided by any industry of their own has graced them, fall in love as it were with themselves. For with this state of mind there is commonly joined an indisposition to appear much in public or engage in business, because business would expose them to many neglects and scorns, by which their minds would be dejected and troubled. Therefore they commonly live a solitary, private, and shadowed life, with a small circle of chosen companions, all devoted admirers, who assent like an echo to everything they say, and entertain them with mouth-homage; till, being by such habits gradually depraved and puffed up, and dazed at last with self-admiration, they fall into such a sloth and listlessness that they grow utterly stupid, and lose all vigour and alacrity. And it was a beautiful thought to choose the flower of spring as an emblem of characters like this: characters which in the opening of their career flourish and acquire celebrity, but disappoint in maturity the promise

of their youth. The fact, too, that this flower is sacred to the infernal deities contains an allusion to the same thing. For men of this disposition turn out utterly useless, and good for nothing whatever; and anything that yields no fruit, but like the way of a ship in the sea passes and leaves no trace, was by the ancients held sacred to the shades and infernal gods."

DEUCALION;

OR RESTORATION.

"The poets relate that, when the inhabitants of the old world were utterly extinguished by the universal deluge, and none remained except Deucalion and Pyrrha, these two, being inflamed with a pious and noble desire to restore the human race, consulted the oracle and received answer to the following effect: They should have their wish, if they took their mother's bones and cast them behind their backs. This response struck them at first with great sorrow and despair; for, the face of nature being laid level by the deluge, to seek for a sepulchre would be a task altogether endless. But at last they found that the stones of the earth (the earth being regarded as the mother of all things) were what the oracle meant.

"This fable seems to disclose a secret of nature, and to correct an error which is familiar to the human mind. For man in his ignorance concludes that the renewal and restoration of things may be effected by means of their own corruption and remains, as the Phœnix rises out of her own ashes. But this is not the case: for matters of this kind have already reached the end of their course, and can give no further help towards a renewal of it; so that the only thing left is to go back to more common and general principles."

The reader may, from these specimens, be tempted to make nearer acquaintance with the book itself, which, like all the

works on which Bacon expended much care, has at least the merits of brevity and point. Mr. Spedding rates it very highly. While acknowledging the entirely different point of view from which we now approach the study of the Greek myths, he says: "The interest which the book still possesses for us (and it has always been a great favourite with me) is of quite another kind; nor has either change of times or increase of knowledge at all abated its freshness. It is an interest precisely of the same kind with that which in the *Essays* shows no symptoms of becoming obsolete. The interpretation of each fable is in fact an 'essay or counsel,' civil, moral, or philosophical; embodying the results of Bacon's own thought and observation upon the nature of men and things, and replete with good sense of the best quality. . . . I see no reason it should not be as great a favourite with modern readers and be found as amusing and instructive as the *Essays* are; the matter being of as good quality, and the form not less attractive." [2]

Appended to the first edition of the *Essays*, was a fragment entitled *Of the Colours of Good and Evil.* Like the *Essays* and the *De Sapientia Veterum*, it is full of shrewd remarks suggested by Bacon's knowledge of life and observations of human nature. It consists of a statement and examination (evidently intended merely as a specimen) of certain commonplaces on good and evil, "showing," as he says, "in what cases they hold, and in what they deceive: which, as it cannot be done but out of a very universal knowledge of the nature of things, so, being performed, it so cleareth man's judgment and election as it is the less apt to slide into any error." Thus, beginning with the old dictum, "That to which all other parties or sects agree in assigning the second place (each putting itself first) should be the best," he passes judgment on it as follows: "The fallax of this colour hap-

[2] Mr. Spedding's Preface to the *De Sapientia Veterum.*

peneth oft in respect of envy; for men are accustomed after themselves and their own faction to incline unto them which are softest, and are least in their way, in despite and derogation of them that hold them hardest to it. So that this colour of meliority and pre-eminence is a sign of enervation and weakness." These *Colours of Good and Evil*, with the addition of two others, were afterwards embodied in the Sixth Book of the *De Augmentis*. Bacon there states that, when a young man, he had collected many other "colours" or "popular signs" of Good and Evil, but, as he had not yet found time to illustrate or examine them, he refrained from setting them out. These are contained in a manuscript in the British Museum, entitled *Promus of Formularies and Elegancies*, and a few specimens of them are given by Mr. Spedding, Bacon's *Works*, vol. vii. pp. 67, 68.

The *Apophthegms New and Old* were first published in December, 1624, but the volume containing them is dated 1625. In the autumn of 1624 Bacon was recovering from a severe illness, and amused himself by dictating such Apophthegms as he could recall. These amount to 280 in number. The subsequent history of the various collections which went under the name of *Bacon's Apophthegms*, though highly curious, is too intricate, and not of sufficient importance to be recounted here. It will be found in Mr. Spedding's Preface to the *Apophthegms*.[3] Several additional Apophthegms have also been appended by him, taken from the second edition of the *Resuscitatio*, the *Baconiana*, and a Common-Place Book in the handwriting of Dr. Rawley, preserved at Lambeth. Many of these stories or sayings are witty or instructive enough, but, as to most well-read men the best of them are probably already familiar, the collection may be disappointing to any one who, in mature life, consults it for the first time. Moreover,

[3] Bacon's *Works*, vol. vii. pp. 113—120.

pointed sayings are much more effective in a setting, and, when presented alone, still more in a collection, are often apt to fall flat. The difference is something like that between seeing antiquities in a museum or in the open field, or paintings in an old church or palace, with which they have been associated for ages, or in a modern picture-gallery. One derives much more amusement from two or three good stories told at a dinner-party, where the conversation leads up to them, than from a whole volume of Ana.

Of the historical works (which, together with the religious works, I include under the general head of Literary Works), the only one of any size is the *History of Henry the Seventh.* This book, though the subject had long been familiar to Bacon, and a fragment on this and the four following reigns dates back as far as the time of Elizabeth, seems to have been wholly composed during the Long Vacation succeeding his fall. On the 8th of October, 1621, he was ready to send a fair manuscript to the king. This was returned shortly after the 7th of January, and on the 20th of March, 1621-2, the book was printed and ready for publication. For some inexplicable reason, a "stay" was interposed by Dr. George Mountain, or Monteigne, Bishop of London, the licenser, but this demur seems soon to have been withdrawn or overruled, for the book was out before the end of the month. A Latin Translation, made either by Bacon himself or under his direction, appeared in the *Opera Moralia et Civilia,* published by Dr. Rawley in 1638. As to the merits of this work, opinions seem to differ widely amongst the few who have read it. Sir James Mackintosh, in his *History of England,* appears to regard Bacon as having simply set to work, in order to gratify James the First, to produce a flattering portraiture of his royal ancestor. Those, however, who will take the trouble to read the book for themselves, will be more likely to agree with Bacon himself, who,

in his dedication to Prince Charles, says: "I have not flattered him, but took him to life as well as I could, sitting so far off, and having no better light." Had Bacon's object been simply to draw a flattering portraiture for the purpose of ingratiating himself with the reigning monarch, he would hardly, in delineating Henry's character, have employed such expressions as these: "he would be blinded now and then by human policy;" "justice was well administered in his time, save where the king was party;" "the less blood he drew, the more he took of treasure, and, as some construed it, he was the more sparing in the one that he might be the more pressing in the other;" "of nature assuredly he coveted to accumulate treasure, and was a little poor in admiring riches;" "he kept a strait hand on his nobility, which made for his absoluteness but not for his safety, insomuch as I am persuaded it was one of the causes of his troublesome reign;" "he was a dark prince and infinitely suspicious, and his times full of secret conspiracies and troubles;" "he was indeed full of apprehensions and suspicions;" "whether it were the shortness of his foresight, or the strength of his will, or the dazzling of his suspicions, or what it was, certain it is that the perpetual troubles of his fortunes (there being no more matter out of which they grew) could not have been without some great defects and main errors in his nature, customs, and proceedings, which he had enough to do to save and help with a thousand little industries and watches."[4] Nor, if Sir James Mackintosh's theory be the true one, can we credit Bacon with much adroitness in telling the following story. "He was a prince, sad, serious, and full of thoughts and secret observations; and full of notes and

[4] These quotations are taken from the character of Henry the Seventh, occurring at the end of the *History*. It must, of course, be understood that they are the dark traits in a portrait which is, on the whole, that of a grand and beneficent personage.

memorials of his own hand, especially touching persons; as whom to employ, whom to reward, whom to inquire of, whom to beware of, what were the dependencies, what were the factions, and the like; keeping (as it were) a journal of his thoughts. There is to this day a merry tale; that his monkey (set on as it was thought by one of his chamber) tore his principal note-book all to pieces, when by chance it lay forth: whereat the court, which liked not those pensive accounts, was almost tickled with sport." Mr. Spedding, who, from his knowledge of the history of the times as well as from the pains he has taken to trace to their sources all Bacon's writings, has a better title to be heard on this subject than any other authority, delivers this weighty judgment: "Though not one of his works which stand highest, either in reputation or popularity with later times, the *History of Henry the Seventh* has done its work more effectually perhaps than any of them. None of the histories which had been written before conveyed any idea either of the distinctive character of the man or the real business of his reign. Every history which has been written since has derived all its light from this, and followed its guidance in every question of importance; and the additional materials which come to light from time to time, and enable us to make many corrections in the history of the events, only serve to confirm and illustrate the truth of its interpretation of them." [5]

In the Second Book of the *Advancement of Learning*, Bacon notes, amongst the deficiencies in modern history, an account of the period of English History from the uniting of the Roses to the uniting of the Kingdoms; "a portion of time wherein, to my understanding, there hath been the rarest varieties that

[5] Spedding's *Account of the Life and Times of Francis Bacon*, vol. ii. pp. 542, 543. See also the Preface to the *History of Henry the Seventh*, Bacon's *Works*, vol. vi. pp. 4, 5.

in like number of successions of any hereditary monarchy hath been known." We have seen that, before the close of the reign of Elizabeth, he had already turned his own attention to this subject. Pressure of business, however, and the absorbing claims of the *Great Instauration* had mostly diverted his attention from it till the period of enforced leisure which succeeded his fall. He then rapidly composed the *History of Henry the Seventh*, the first reign of the series. Prince Charles, to whom this work was dedicated, urged him to proceed with his original plan, and to write a *History of Henry the Eighth*. Bacon appears somewhat reluctantly to have yielded, for the business would be a long one, and his heart was far more deeply engaged in philosophy than in history. Moreover, for some reason or other, Sir Robert Cotton began to show some reluctance to allowing him the continued use of his treasures. "I find Sir Robert Cotton," he says, "who poured forth what he had in my former work, somewhat dainty of his materials in this." The opening paragraph is the only part of this projected writing which was ever executed.

The piece entitled *In Felicem Memoriam Elizabethæ* (On the Fortunate Memory of Elizabeth, Queen of England), though it can hardly be regarded as connected with the same design as the *History of Henry the Seventh* and the projected *History of Henry the Eighth*, falls within the same period. It seems to have been written in the summer of 1608, and was intended as an answer to the aspersions cast on Elizabeth's character and government by Roman Catholic pamphleteers. By way of reply to the Pope's description of her as "misera fœmina," Bacon enumerates the various particulars in which her life and government were to be regarded as remarkable for felicity. In a letter to Sir George Carew, then Ambassador in France, he expresses a wish that the piece should be seen by the President De Thou (Thuanus), "chiefly because I know not

whether it may not serve him for some use in his story." This eulogy may be viewed as an impartial and independent testimony to the worth and prudence of Elizabeth; for Bacon had no special reason to be grateful to her, nor, at the time at which the piece was written, could he have served any personal object by magnifying the events of her reign.

Two other small pieces belong to the same series. One is a memorial of Henry Prince of Wales (*In Henricum Principem Walliæ Elogium Francisci Baconi*), the eldest son of James, who died prematurely in 1612. It was first printed by Birch, in his edition of Bacon's works, 1763, from a manuscript in the British Museum. The other is a small fragment in English, entitled *The Beginning of the History of Great Britain*, giving an account of the accession of James the First to the Crown of England. It was first published in Rawley's *Resuscitatio*, 1657, and, according to Mr. Spedding, was probably composed at the end of 1609 or beginning of 1610. Mr. Spedding says of it: "As an account of the temper of men's minds at James's entrance, it is complete; and in my judgment one of the best things in its kind that Bacon ever wrote."

Bacon's religious works, though they contain some of his finest sentiments, and are mostly written in his best style, might be contained in a very thin volume. The largest of them is the *Meditationes Sacræ*, first published, in the same volume with the *Essays* and the *Colours of Good and Evil*, in 1597. Amongst the most characteristic of the subjects there treated are "The Innocency of the Dove and the Wisdom of the Serpent," "The Exaltation of Charity," "Earthly Hope," "The Kinds of Imposture." The original is in Latin, but, in the reprint of the *Essays* in 1598, the *Meditations* appear in English, whether with or without Bacon's *imprimatur* we do not know. The other genuine works of this class are *A Confession of*

Faith, first published in the *Re ains* in 1648, but written before (how long before we cannotde ermine) the summer of 1603; a *Translation of certain Psalms into English Verse*, composed during his fit of sickness in 1624, which were dedicated to "his very good friend Mr. George Herbert,"[6] and published in 1625; and three Prayers, one called by him *The Student's Prayer*, another called by him *The Writer's Prayer*, and a third composed, in the midst of his troubles, in the spring of 1621. Of this last prayer Addison (in the *Tatler*, No. 267) says that "For the elevation of thought and greatness of expression, it seems rather the devotion of an angel than of a man." A fourth Prayer, described in the *Remains* as "made and used by the late Lord Chancellor," but not mentioned by either Rawley or Tenison, is of doubtful authenticity. Lastly, a piece entitled *The Characters of a Believing Christian in Paradoxes and Seeming Contradictions*, which was also published in the *Remains*, and has frequently been quoted as Bacon's under the short title of *Christian Paradoxes*, has now been shown by Mr. Alexander Grosart to have been written by another hand. It formed a portion of the second part of Herbert Palmer's *Memorials of Godliness and Christianity*, and was first published by him in 1645.[7] As I have

[6] As George Herbert is himself a man of famous memory, and the dedication is brief, I give it in full: "To my very good friend Mr. George Herbert. The pains that it pleased you to take about some of my writings I cannot forget; which did put me in mind to dedicate to you this poor exercise of my sickness. Besides, it being my manner for dedications to choose those that I hold most fit for the argument, I thought that in respect of divinity and poesy met (whereof the one is the matter, the other the style of this little writing), I could not make better choice. So, with signification of my love and acknowledgment, I ever rest, "Your affectionate friend,

"Fr. St. Alban."

[7] On the history of this extraordinary literary mistake (for Palmer's work went through no less than twelve editions within the next sixty-

devoted a portion of a later chapter to discussing the character of Bacon's religious opinions, I need not dwell any longer on this division of his works. I may, however, say that no one can form any adequate opinion on the vexed question of Bacon's attitude towards religion and religious controversies, unless he takes into consideration the various passages bearing on these topics, which are scattered over his *Essays* and his philosophical writings.

The professional works lie so much without the scope of my present concern with Bacon, that I shall hardly do more than notice them. A collection of all those which still possess any importance has been brought together and annotated by Mr. D. D. Heath in the seventh volume of Ellis and Spedding's edition of Bacon's works. The largest and most important of these are the treatises entitled *Maxims of the Law*, and the *Reading on the Statute of Uses*. The treatise entitled the *Use of the Law* is regarded by Mr. Heath as spurious. The *Maxims of the Law* were Bacon's contribution, "a sheaf and cluster of fruit," towards that Digest of the Laws of England which became at an early period of his life a favourite idea with him, and of which he never wholly lost sight. The dedication to Queen Elizabeth bears date January 8, 1596, but there are reasons for thinking that the body of the work was re-touched, and, in its present shape, belongs to a later period. The *Reading on the Statute of Uses*, Mr. Heath says, "has perhaps received more attention than the *Maxims*. It has always been cited with respect, and was edited in 1804, with notes far exceeding the text in length, by Mr. Rowe. It is however only a fragment of a course

three years), see Mr. Spedding's *Letters and Life of Bacon*, vol. vi. pp. 129—131. Mr. Grosart's discovery appears in a book, printed for private circulation in 1864, entitled *Lord Bacon not the author of the Christian Paradoxes*.

which Bacon was called upon to give in Gray's Inn as Double Reader in 1600." Of the *Arguments of Law*, the one perhaps of most historical interest is that in the case of the Post-Nati of Scotland, delivered in the Exchequer Chamber before Easter Term, 1608, while Bacon was Solicitor-General. Another Argument of antiquarian, if not of historical, interest is that on the Jurisdiction of the Council of the Marches, propounded in the same year. What Mr. Heath finds "most striking, both here and in the argument on the Writ *Rege Inconsulto*, is the ease with which Bacon throws off the tone of the Minister of State and the courtier when he comes to argue before Common Law Judges." In connexion with the professional works, a conjecture of Mr. Spedding's [8] ought to be noticed. He suspects that all the corrected copies of Bacon's legal works, which he had selected for preservation, were lost altogether or have survived only in the rough drafts.

It may be convenient to some of my readers, if I here say something of the various collections of Bacon's posthumous works, which appeared from time to time during the seventeenth and eighteenth centuries. It will be recollected that the *Essays*, in three different forms, had come out respectively in 1597, 1612, and 1625, and that to the first of these editions was appended the *Meditationes Sacræ* and the *Colours of Good and Evil;* that the *Advancement of Learning* was published in 1605; the *De Sapientia Veterum* in 1609; the *Novum Organum* in 1620; the *History of Henry the Seventh*, and the *Historia Ventorum* in 1622; the *Historia Vitæ et Mortis* in 1623; the *De Augmentis Scientiarum* in October, 1623; and the *Apophthegms* and *Translation of Certain Psalms* in 1625. Excepting political pamphlets or state papers, such as the *Declaration of the Practices and Treasons attempted and committed by Robert,*

[8] *Letters and Life*, vol. vii. p. 352; *Life and Times*, vol. ii. p. 622.

late Earl of Essex (for which, however, he was not wholly responsible), *Sir Francis Bacon, his Apology in certain imputations concerning the late Earl of Essex,* the *Charge touching Duels,* &c., these are all the works which were published during Bacon's lifetime. In 1627, the year after his death, his chaplain, Dr. Rawley, brought out the *Sylva Sylvarum,* with the *New Atlantis* appended. All Bacon's more important works, and certainly all those by which he is now best known, had thus been published in 1627. But amongst his papers were found a number of speeches, letters, beginnings or first drafts of treatises, heads of advice, memoranda, &c., which served several successive editors for collections of miscellanies. The first of these collections was that contained in the small volume, published by Dr. Rawley in 1629, under the title of *Certain Miscellany Works.* It contains *Considerations touching a War with Spain,* the *Advertisement touching a Holy War, An offer to the King of a Digest to be made of the Laws of England,* and the short fragment on the *History of the Reign of King Henry the Eighth.* Comparing it with the *parva naturalia* of Aristotle, Dr. Rawley calls this collection the *parva politica* of Bacon. In 1638, Dr. Rawley published the Latin volume, entitled *Opera Moralia et Civilia.* This contains, in addition to reprints of the *De Augmentis,* the *Historia Ventorum,* the *Historia Vitæ et Mortis,* and (with slight variations) the *De Sapientia Veterum,* translations of the *History of Henry the Seventh,* the *Essays* (latinised as *Sermones Fideles sive Interiora Rerum*), the *New Atlantis,* and the *Holy War.* These translations, as well as the *De Sapientia Veterum,* are described as, except in a few particulars, put into Latin by the author himself.[9] The next volume of Collections was published anonymously in 1648, and was entitled "*The Remains of Francis, Lord Verulam,*

[9] *Ab ipso Honoratissimo Auctore, præterquam in paucis, Latinitate donatus.*

&c., being Essays and several Letters to several great personages, and other pieces of various and high concernment not heretofore published." There is no preface, or any explanation of the principle of selection or of the sources from which the pieces had been brought together. It contains several letters, Bacon's opinion concerning the disposition of Sutton's charity (the Charterhouse estate), the *Confession of Faith*, the *Christian Paradoxes*, which, as we have seen, were by another hand, and the Prayer of doubtful authenticity, mentioned on p. 57. The authenticity of any document contained in this collection requires to be supported by independent testimony.

In 1653 appeared a far more important volume, that published in an elegant duodecimo at Amsterdam by Isaac Gruter, and entitled *Francisci Baconi de Verulamio Scripta in Naturali et Universali Philosophia.* It contains a large number of Bacon's smaller philosophical pieces, such as the *Cogitata et Visa*, the *Descriptio Globi Intellectualis*, the *Scala Intellectus*, *Prodromi Philosophiæ Secundæ*, &c. It is divided into two parts, the latter of which is called *Impetus Philosophici*, but, so far as concerns the character of the pieces, there is no ground for the division.[1] The reader may naturally ask, how came so important a collection to be first issued in Holland? Sir Robert Rich and Mr. Thomas Meautys, two of Bacon's creditors, to whom letters of administration were granted about fifteen months after his death, the executors named in his will having refused or delayed to assume their office, appear to have handed over these documents to a Mr. Bosville, to whom, together with Sir John Constable, who had married Bacon's wife's sister, the care of his papers had been bequeathed in his will. Most of Bacon's unpublished manuscripts had the good fortune to fall into the hands of Dr. Rawley, but these of which I am speak-

[1] The circumstances which probably led to this division are described by Mr. Spedding in the Preface to the Third Volume of Bacon's *Works*.

ing, together with others which possibly were never published and may now have disappeared,[2] were sent over to Mr. Bosville (afterwards better known as Sir William Boswell), who, soon after Bacon's death, had become the agent of the English Government at the Hague. By Sir William Boswell these papers were handed on to Isaac Gruter. If he was charged with their publication, the commission seems to have been only imperfectly performed.

Another important collection of pieces was issued in 1657. This was a miscellaneous collection, edited by Rawley, under the title of "*Resuscitatio*, or bringing into public light several pieces of the works, civil, historical, philosophical, and theological, hitherto sleeping, of the Right Honourable Francis Bacon," &c. This volume contains Speeches, Letters, and several short treatises and discourses, chiefly of a political character. To it is prefixed a "Life of the Honourable Author," since frequently reprinted. In the Epistle to the Reader, Dr. Rawley speaks of the "sundry corrupt and mangled editions" of Bacon's writings,[3] "whereby nothing hath been more difficult than to find the Lord St. Alban in the Lord St. Alban." New editions of the *Resuscitatio* were brought out in 1661 and 1671 respectively, both containing new matter, but Dr. Rawley, who died in 1667, is only responsible for the second edition. It may be mentioned that, in this edition, some new sentences are introduced into the Life of the Author. The *Resuscitatio* is a collection of English pieces or translations only, but in 1658, the year following its publication, Rawley redeemed his promise of bringing out a small collection of Latin works, so

[2] They may, however, be included in the *Resuscitatio* and *Opuscula* of Rawley. See Preface to the Third Volume of Ellis and Spedding's Bacon, pp. 8, 9.

[3] Rawley was probably alluding specially to the *Remains* and to the letters contained in the *Cabala* and *Scrinia Sacra*.

as not "to leave to a future hand anything of moment and communicable to the public." This collection is entitled *Opuscula Varia Posthuma, Philosophica, Civilia, et Theologica, Francisci Baconi*, &c. To it is prefixed a Latin translation of the Life. The principal contents are the *Historia Densi et Rari*, the *Historia Soni et Auditus*, and the *In Felicem Memoriam Elizabethæ*. It also includes several small pieces, such as the *Inquisitio de Magnete* and the *Imago Civilis Julii Cæsaris*.

Thomas Tenison, afterwards Archbishop of Canterbury, who had access to Rawley's papers after his death,[4] published in 1679, a small volume entitled "*Baconiana*, or certain genuine remains of Sir Francis Bacon," &c. This volume contains, by way of introduction, an "account of all the Lord Bacon's works" of considerable interest to the bibliographer. The charges against the Earl and Countess of Somerset are here first printed in an authentic form, and the admirers of Bacon had reason to be grateful to Tenison for rescuing from oblivion several charming pieces, such as the *Student's Prayer* and the *Writer's Prayer* in English, and the letters to the University of Cambridge and Trinity College on presenting them with copies of his books.

A collection of Bacon's unpublished letters, written during the reign of James the First, was published by Robert Stephens in 1702. A second volume, also collected by him, was published in 1734. In addition to letters, this latter volume contains several tracts and fragments, the most important, perhaps, of which is the *Redargutio Philosophiarum*, only a small portion of which had been published by Gruter in 1653. Finally, another collection of unpublished Letters, Speeches, &c., was issued by Dr. Thomas Birch in 1763. These, with some addi-

[4] At some time or other, Tenison himself became possessed of these papers, and they are now in the Archiepiscopal Library at Lambeth.

tions, occupy the sixth volume of the old ten-volume edition of Bacon's works.

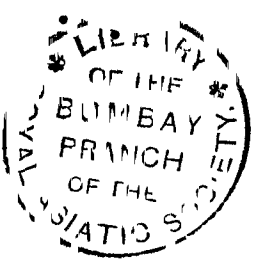
None of Bacon's legal works were published during his lifetime. In 1630 appeared, in pamphlet form, "*The Elements of the Common Laws of England,* branched into a double tract, by the late Sir Francis Bacon, Knight," &c. The first of these tracts was the *Maxims of the Common Law,* the second the *Use of the Common Law.* The latter tract, it has already been stated, Mr. Heath regards as spurious. The *Reading on the Statute of Uses* was first published, in a very incorrect form, in 1642. Three Speeches concerning the Post-Nati of Scotland, the Naturalization of the Scotch in England, and the Union of the Laws of the kingdoms of England and Scotland, were first published in 1641. The Four Arguments on Impeachment of Waste, Lowe's case of Tenures, the case of Revocation of Uses, and the Jurisdiction of the Council of the Marches, first appeared in Blackbourne's edition of Bacon's entire works, published in 1730. Bacon's argument in Chudleigh's case has been recovered by Mr. Spedding.

The first edition, professing to be complete, of Bacon's works, issued in England, was that of Blackbourne, in 1730.[5] What long served as the trade edition was a reprint of the edition put out by Birch in 1763. A handsome, but ill-arranged, edition, under the superintendence of Mr. Basil Montagu, was issued by Pickering between 1825 and 1836. The appearance of this edition was the occasion of Macaulay's Essay. The splendid and carefully annotated edition of Ellis, Spedding, and Heath, in seven volumes, was brought out by Longmans

[5] Collections of Bacon's *Works,* which professed to be, or might be regarded as, *Opera Omnia,* had been published, before the end of the eighteenth century, at Frankfort-on-the-Main, Amsterdam, and Leipsic. So far as letters, speeches, and miscellaneous fragments are concerned, all these were necessarily very imperfect.

in 1857 and following years. No one, who wishes to study Bacon's works as a whole, can now dispense with its assistance. Mr. Spedding has incorporated the letters and occasional works of Bacon in another work, occupying seven volumes, entitled *Letters and Life of Bacon*, Longmans, 1861 and following years. This work will be found to be an invaluable acquisition to the student of history, not only as regards the life of Bacon but the events of his period generally. The substance of it, omitting most of the letters but retaining the greater part of the biography, has recently appeared under the title of *The Life and Times of Francis Bacon*, 2 vols., Trübner and Co., 1878.

Of Bacon's separate works, the most recent edition of the *Advancement of Learning* is that of Mr. Aldis Wright, and of the *Novum Organum* my own, both issued by the Clarendon Press at Oxford. Amongst recent editions of the *Essays* are those of Archbishop Whately, Mr. Aldis Wright, and Dr. Abbott. The Clarendon Press is shortly about to issue an edition, annotated by Mr. J. R. Thursfield.



CHAPTER III.

BACON'S SURVEY[1] OF THE SCIENCES.

THE divisions, existing condition, and deficiencies of the sciences are the subject of three of Bacon's works,—namely, the *Advancement of Learning*, published in 1605, the *De Augmentis Scientiarum*, published in 1623, and the *Descriptio Globi Intellectualis*, which, though written about 1612, was first published by Gruter in 1653.[2] For the purposes of this chapter, it will be sufficient to confine our attention to the second of these treatises, Of its relation to the first I have already spoken. The third, though curious, as expressing (in conjunction with the *Thema Cœli*, which really forms part of the same work) the opinions entertained by Bacon on the disputed questions of astronomy almost immediately after the publication of Galileo's *Syderus Nuncius*, is of too fragmentary a character to claim any of the space at my disposal.

The first book of the *De Augmentis* is, with some variations, a translation into Latin of the first book of the *Advancement of Learning*, already described, and need not detain us. The distribution of the Sciences (*Partiones Scientiarum*), the subject of the first part of the *Great Instauration*, properly begins

[1] Quaintly called by Bacon his "perambulation."

[2] A few chapters of the curious but interesting fragment *Valerius Terminus* bear on the same subject, but they are too slight to be mentioned by the side of the other treatises.

with the second book. As his basis of division, Bacon takes "the three faculties of the rational soul" (or, as he calls them in the *Advancement of Learning*, "the three parts of man's understanding"). "History has reference to the Memory, poesy to the Imagination, and philosophy to the Reason. And by poesy here I mean nothing else than feigned history, or fables; for verse is but a character of style." "History is properly concerned with individuals, which are circumscribed by place and time. For though Natural History may seem to deal with species, yet this is only because of the general resemblance which in most cases natural objects of the same species bear to one another; so that when you know one, you know all." "Poesy, in the sense in which I have defined the word, is also concerned with individuals; that is, with individuals invented in imitation of those which are the subject of true history. There is, however, this difference that Poesy frequently exceeds the measure of nature, joining at pleasure things which in nature would never have come together, introducing things which in nature would never have come to pass; just as Painting likewise does. This is the work of Imagination." "Philosophy discards individuals; neither does it deal with the impressions immediately received from them, but with notions abstracted from those impressions: in the composition and division whereof according to the law of nature and the evidence of fact its business lies. And this is the office and work of Reason." "That these things are so, may be easily seen by observing the beginnings of the intellectual process. The sense, which is the door of the intellect, is affected by individual objects only. The images of those individuals—that is, the impressions received by the sense—are fixed in the memory, and pass into it, in the first instance, entire as it were, just as they occur. These the human mind proceeds to review and ruminate on; and, thereupon, either

simply rehearses them, or makes fanciful imitations of them, or analyses and classifies them. Wherefore from these three fountains, Memory, Imagination, and Reason, flow these three emanations, History, Poesy, and Philosophy; and there can be no others. For I consider history and experience to be the same thing, as also philosophy and the sciences."

So far the division has only been one of human learning. But, when we examine the contents of divine learning, we shall find that the same division is applicable to them. "Nor do I think that any other division is wanted for Theology. The information derived from revelation and the information derived from the sense differ no doubt both in the matter and in the mode of conveyance; but the human mind is the same, and its repositories and cells the same. It is only as if different liquids were poured through different funnels into one and the same vessel. Theology therefore consists either of Sacred History, or of Parables, which are a divine poesy, or of Doctrines and Precepts, which are a perennial philosophy. For as for that part which seems supernumerary, namely, Prophecy, it is but a kind of history: for divine history has this prerogative over human, that the narration may be before the event, as well as after."[3]

The principal subdivisions, according to Bacon's scheme, are these. History is either Natural or Civil, Natural History treating of the works of Nature, Civil History of the works of Man. Civil History includes Literary and Ecclesiastical History, as well as the history of states, though in the *Advancement of Learning* the two former are made separate divisions. Natural History is divided into the history of generations, in which nature follows her ordinary course of developement, of præter-generations, that is of monsters or

[3] *De Augmentis*, book ii. ch. 1. In my quotations throughout this chapter, I have adopted, with slight variations, the translation published in Ellis and Spedding's edition of Bacon's *Works*, vols. iv. and v.

portents, and of arts, by which nature is "put in constraint, moulded, and made as it were new by the hand of man." "Of these the first treats of the Freedom of Nature, the second of her Errors, the third of her Bonds." "And I am the more induced," adds Bacon, putting forward one of his most characteristic tenets, "to set down the History of the Arts as a species of Natural History, because an opinion has long been prevalent, that art is something different from nature, and things artificial different from things natural; whence this evil has arisen, that most writers of Natural History think they have done enough when they have given an account of animals or plants or minerals, omitting altogether the experiments of mechanical arts."[4] The Appendices to Civil History, which record the works of men as history itself records their actions, are Orations, Letters, and Apophthegms. The second principal part of learning, or Poesy, which is feigned history, is divided into Poesy Narrative, Dramatic, and Parabolical. "Narrative Poesy is a mere imitation of History, such as might pass for real, only that it commonly exaggerates things beyond probability. Dramatic Poesy is as History made visible; for it represents actions as if they were present, whereas History represents them as past. Parabolical Poesy" (which, as he says afterwards, is of a higher character than the others, and appears to be something sacred and venerable) "is typical history, by which ideas that are objects of the intellect are represented in forms that are objects of the sense."[5] "The object of philosophy is threefold—God, Nature, and Man; as there are likewise three kinds of rays—direct, refracted, and reflected. For nature strikes the understanding with a ray direct; God, by reason of the unequal medium (namely, his creatures), with a ray refracted; man, as shown and exhibited to himself, with a ray reflected." These three branches of philosophy, however, all meet in one trunk,

[4] Book ii. ch. 2.

[5] Book ii. ch. 13.

the Philosophia Prima, which is, as it were, the common parent of the particular sciences, embodying those axioms and discussing those problems which are not peculiar to any one science but find their place in all knowledge alike.[6]

"That knowledge, or rather glimmering of knowledge, concerning God, which may be obtained by the light of nature and the contemplation of his creatures," is called Natural Theology. The second part of Philosophy, or Natural Philosophy, is divided into Speculation, or the inquiry into causes, and Operation, or the production of effects. Speculative Philosophy, again, is divided into Physic, which is concerned with material and efficient causes, that is, the materials out of which and the agents by which effects are produced, and Metaphysic, which is concerned with final and formal causes, or the ultimate purposes which things subserve and that innermost constitution or essence from which the other properties of an object or quality are derived. The operative doctrine concerning nature admits likewise of two divisions: Mechanic corresponding with Physic, and Magic corresponding with Metaphysic. Mechanic depends on a knowledge of the efficient and material causes, Magic on a knowledge of the Form. "For the inquisition of Final Causes is barren, and, like a virgin consecrated to God, produces nothing." To know the ends which an object subserves does not enable us to produce it. A knowledge of the material and efficient causes does indeed often enable us to bring about mechanical effects. "But they who devote themselves to these studies, do but creep as it were along the shore "premendo litus iniquum," hugging the coast." There is a surer and more far-reaching mode of operation, Bacon conceived, than any now in use. It is to ascertain the ultimate circumstance or circumstances on

[6] Book iii. ch. i. I have described and discussed Bacon's conception of Primary Philosophy in ch. 5, pp. 175—178.

which all the others depend, and then by duly disposing the former to produce the latter. Thus, to take Bacon's own instance from the second book of the *Novum Organum*, if heat be a certain kind of motion amongst the minute particles of a body, the surest and most effectual mode of producing heat will be to initiate this motion. To operations of this kind, depending on a knowledge of the Form, he appropriates the term Magic. "It seems to me that there can hardly be discovered any radical or fundamental alterations and innovations of nature, either by accidents, or the trial of experiments, or even from the light of physical causes; but only by the discovery of Forms. If then I have set down that part of metaphysic which treats of forms as deficient, it must follow that I do the like of natural magic, which has relation thereunto. But I must here stipulate that magic, which has long been used in a bad sense, be again restored to its ancient and honourable meaning. For among the Persians [7] magic was taken for a sublime wisdom and the knowledge of the universal consents of things; and so the three kings who came from the east to worship Christ were called by the name of Magi. Now I understand it as the science which applies the knowledge of hidden Forms to the production of wonderful operations; and, by uniting, as they say, actives with passives, displays the wondrous works of nature." [8] Mathematic (which is divided into Pure and Mixed) is the great appendix and auxiliary to Natural Philosophy, whether speculative or operative. Bacon is aware that "the received," that is the Aristotelian, arrangement re-

[7] This remark is in accordance with Bacon's idea that a profound wisdom, now lost, existed in the ancient world. See last chapter, pp. 46, 47.

[8] Book iii. ch. 5. On Bacon's conception of Forms, the importance which he attached to their discovery, and the practical bearings of his doctrine, I shall speak at length in ch. 4. See pp. 107—119.

cognizes Mathematics as a branch of speculative philosophy co-ordinate with Physics and Metaphysics. But he thinks it necessary to represent it as only the handmaid of the other two, "by reason of the daintiness and pride of mathematicians, who will needs have this science almost domineer over Physic." "For it has come to pass, I know not how, that Mathematic and Logic, which ought to be but the handmaids of Physic, nevertheless presume on the strength of the certainty which they possess to exercise dominion over it."[9]

No less than five books of the *De Augmentis* (Books iv.—viii.) are devoted to "the doctrine concerning Man," or what we should now call Anthropology, in the widest sense of that term. "This has two parts; for it considers man either segregate, or congregate and in society." The one is called the Philosophy of Humanity or Human Philosophy, the other Civil Philosophy. "The Philosophy of Humanity consists of parts similar to those of which man consists; that is, of sciences which respect the body, and of sciences which respect the mind, besides comprehending one general science concerning the nature and state of man or concerning those things which are common as well to the body as the soul." "The doctrine concerning man's body receives the same division as the good of man's body to which it is subservient. The goods of man's body are four; Health, Beauty, Strength, Pleasure. The sciences therefore are in number the same; Medicine, Cosmetic, Athletic, and Voluptuary, which Tacitus calls 'eruditus luxus,' educated luxury." The doctrine concerning the human Soul (in which we must distinguish between the Rational Soul, which is divine, and the Sensible or Produced Soul, which is common with brutes,[1]) is concerned either with the Substance

[9] Book iii. ch. 6.

[1] For Bacon's distinction between these two kinds of soul and other matters connected with his Psychology, see ch. 5, pp. 161—168.

and Faculties of the Soul or with the Use and Objects of the Faculties, the latter doctrine being divisible into Logic and Ethic. Logic is taken in a wide sense, as including the arts of Invention, Judgment, Retention, and Tradition. These, again, are subdivided, as, for instance, the art of Invention into the discovery of Arts and the discovery of Arguments. Ethic or moral knowledge is divided into "two principal doctrines: the one the Exemplar or Platform of Good, the other the Regiment or Culture of the Mind; the one describing the nature of good, the other prescribing rules how to accommodate the will of man thereunto." Civil Philosophy, the second great division of "the doctrine concerning Man," "has three parts, according to the three summary actions of Society: the knowledge of conversation, the knowledge of negotiation, and the knowledge of empire or government. For there are three kinds of good, which men seek to acquire for themselves from civil society: comfort against solitude, assistance in business, and protection against injuries. And there are these three wisdoms of divers natures, which are often found separate: wisdom in conversation or behaviour, wisdom in business, and wisdom in state."[2] The science of Universal Justice or the Fountains of Equity falls under the last of these three divisions, but is noted as deficient.

The few paragraphs which constitute the last or ninth book refer to the study of Theology, that is Sacred or Inspired Theology, as distinct from Natural Theology, which is regarded as a branch of philosophy. Bacon does not attempt any further division of this subject than that which he had suggested, as parallel to the division of Human Learning, at the beginning of Book ii. But he proposes three Appendices, relating however "not to the matter concerning which theology gives or shall give information, but only to the manner in which the informa-

[2] Book viii. ch. 1.

tion is or may be imparted." These are the legitimate use of the human reason in matters of religion, the limits of toleration within the church, and the interpretation of the Scriptures by means of annotations on particular texts (fancifully called "the Emanations of the Scriptures"), all of which he notes as deficient.

Such are the main outlines of Bacon's Partitions of the Sciences. Faulty as this classification is both in the principle on which it is constructed and in many of its particulars, he deserves great credit for having attempted, on independent grounds, to frame a new chart of knowledge adequate to the existing and what he conceived might not unreasonably be looked forward to as the prospective state of learning. Even if the map were not altogether accurate, it might, with its comparatively full details, still serve the purpose of suggesting new voyages of discovery, and of indicating to each band of explorers the light to be gained from the study of other departments of knowledge.[3] Man's acquaintance with the intellectual, like his acquaintance with the material, world had grown vastly since the days of Aristotle and the Stoics. Why should he still be confined to their meagre enumerations of the sciences? The two commonly received systems of distribution were those of the Peripatetics and the Stoics. The Peripatetics,

[3] "At the period when Bacon wrote, it was of much more consequence to exhibit to the learned a comprehensive sketch than an accurate survey of the intellectual world; such a sketch as, by pointing out to those, whose views had been hitherto confined within the limits of particular regions, the relative positions and bearings of their respective districts, as parts of one great whole, might invite them all, for the common benefit, to a reciprocal exchange of their local riches. The societies or academies which, soon afterwards, sprung up in different countries of Europe, for the avowed purpose of contributing to the general mass of information by the collection of insulated facts, conjectures, and queries, afford sufficient proof that the anticipations of Bacon were not, in this instance, altogether chimerical."—Dugald Stewart's *Dissertation*, Preface.

following Aristotle in their main division and in their two first subdivisions, but supplying the third subdivision themselves, had classified the departments of knowledge as speculative (*θεωρητικαί*), practical (*πρακτικαί*), and artistic or productive (*ποιητικαί*): subdividing speculative knowledge into physic, mathematic, and theology (or, as the highest grade of knowledge was variously called, metaphysic or the first philosophy); practical knowledge into ethic, œconomic, and politic; and artistic, constructive, or creative knowledge (*ποιητική*) into dialectic or logic, rhetoric, and poetic. Mathematic was also commonly divided into arithmetic, geometry, astronomy, and harmonics (music), the *quadrivium* of the mediæval universities. The Stoics proposed what was apparently a simpler division in their threefold scheme of Logic (which was made to include grammar and rhetoric), Ethics, and Physics (including Theology). This division corresponds with the one proposed by Locke in the last chapter of the *Essay on the Human Understanding*. Bacon's scheme, however open it may be to criticism, at least prepared the way, by the copious details into which it entered, for a thorough discussion of the relations subsisting between the various sciences as well as for discovering the deficiencies which remained to be supplied in them.

It is a great historical testimony to the excellence of Bacon's classification that, with comparatively slight alterations, it was adopted by D'Alembert in his Preliminary Discourse to the French *Encyclopédie*. Amongst the principal changes which it there assumed may be enumerated the following. The places of Imagination and Reason, Poetry and Philosophy, are reversed, so that, in the scheme of the *Encyclopédie*, Poetry comes last; the Imagination being regarded by D'Alembert as a more mature faculty (he is, of course, speaking of the creative not of the merely re-productive Imagination) than the Reason, and posterior to it in the order of developement. Revealed Theology,

instead of being treated as co-ordinate with and distinct from Human Learning, is included under that part of Philosophy which is concerned with the knowledge of God, Natural Theology and the Science of evil spirits being the co-ordinate branches. Metaphysic is used in no less than three senses. In one sense, it is General Metaphysic, that is ontology or the Science of Being in general,—of Possibility, Existence, Duration, &c. In this sense, it stands at the head of Philosophy, and has a certain affinity to the Philosophia Prima of Bacon. In another sense, it is employed as the equivalent of Pneumatology, or the science of souls as distinct from bodies, and in this sense is called Particular Metaphysic. Finally, there is a metaphysic of bodies, or general physic, which treats of extent, movement, impenetrability, &c., or the properties common to all bodies. Mathematics is made one of the main divisions of the Philosophy of Nature, instead of a mere appendix, and the mathematical as well as the physical sciences are much more elaborately divided than in Bacon's classification. The various medical sciences, or those which have to do with the care of man's body, are classified on a more scientific basis, and transferred from the Philosophy of Man to the Philosophy of Nature. Morals are divided into general and particular: general ethics being concerned with discussions on the nature of good and evil, on the necessity of being virtuous, &c.; particular ethics with the special duties of the individual when regarded alone, of man in the family, and of man in society, denominated respectively Natural, Economical, and Political Jurisprudence, a similar division being applicable to the conduct of states. Poesy is not confined to Poetry proper, but is made co-extensive with the Fine Arts in general. Notwithstanding, however, these numerous divergences, the points of agreement between the schemes of Bacon and D'Alembert seem to me to be much more important than those of difference. But

it was not only in the classification of the sciences, that the Encyclopedists were indebted to Bacon. To him they owed their conception of the whole work, and Diderot and D'Alembert are never weary of acknowledging the obligation. "If we emerge from this vast operation," wrote Diderot in the Prospectus, "we shall owe it mainly to the chancellor Bacon, who sketched the plan of an universal dictionary of sciences and arts at a time when there were not, so to speak, either arts or sciences. This extraordinary genius, when it was impossible to write a history of what men already knew, wrote one of that which they had to learn." "No more striking panegyric has ever been passed," says Mr. Morley,[4] "upon our immortal countryman than is to be found in the Preliminary Discourse. The French *Encyclopédie* was the direct fruit of Bacon's magnificent conception."

The radical fault in Bacon's classification of the sciences arises from his adopting a distinction between the so-called faculties as the basis of his division. It is awkward, to begin with, to make Memory include perception and the trained habit of observation. Then, Imagination has to be taken in a special sense, as a combining and creative faculty, while Reason must be made to include processes like Abstraction and Generalisation. But, apart from these objections, it is plain, on a little consideration, that all these mental acts are so implicated in every intellectual process of any length or complexity, that it is impossible definitely or even approximately to assign one subject to the domain of one faculty and another to that of another. Thus, in Civil History, we not only have to try to reproduce the facts as they occurred (which part of the work Bacon would have assigned to Memory), but we must often follow long trains of reasoning and imagine various complications of circumstances in order to account for the

[4] *Diderot*, by John Morley, vol. i. p. 116.

sequence of events or the motives of those who were actors in them. And it is superfluous to remark that we can neither infer a single conclusion nor combine any two ideas, without the intervention of memory. Difficult as it is to frame any rules on such a subject, it may be laid down with confidence that the principles of classification ought to be sought in the nature of the Sciences themselves, and not in the intellectual acts by which we apprehend or develope them.

When we come to criticize Bacon's scheme in details, we are especially struck, from our present stand-point, with the clumsy device of constituting Appendices; with the difficulty he experiences in properly co-ordinating mathematical with physical science; with the inclusion of the doctrine concerning the Body of Man (comprehending, as it does, Medicine and Anatomy) under the head of Human rather than of Natural Philosophy, thereby co-ordinating it not with the physical but with the moral sciences; with the peculiar province assigned to Metaphysic; and, lastly, not to multiply examples, with the vague and inadequate divisions of Physics. It must be recollected, however, that Bacon was acting, in this field, as a pioneer, and we ought rather to be grateful to him for the work which he achieved and the example which he set than nicely to estimate his errors and defects.

Of more recent attempts to classify the various departments of human knowledge, it would be out of place here to offer any detailed account. Every philosopher who is possessed with the ambition of framing a complete system of philosophy must either accept such a classification ready-made (an alternative the choice of which would argue considerable modesty), or try to construct one for himself. The efforts of Hegel, Comte, and Herbert Spencer, in this direction, will be familiar to many of my readers. Hegel's classification is to be found in the elaborate work, entitled *Encyklopädie der Philosophischen Wissen-*

schaften, a brief account of which is given by Mr. Wallace in his article on Hegel in the *Encyclopædia Britannica*. The Synoptical Table of Comte occurs in the first volume of the *Philosophie Positive*, and is explained and justified in the second lecture contained in the same volume. Mr. Herbert Spencer proposes a new classification, based on the distinction of Abstract and Concrete (to which, however, he adds a third division, the Abstract-Concrete), in an Essay on the Classification of the Sciences, contained in the third volume of his *Essays* and also published separately. Mr. Bain criticizes this and other schemes in one of the Appendices to his *Deductive Logic*, stating his own views in the Introduction to the same work. J. S. Mill, who with certain important reservations, approves Comte's classification, has examined this subject at considerable length in his work on *Auguste Comte and Positivism* (pp. 33—67). Comte's design, could it be successfully executed, would no doubt be of great advantage to the student. It is no less than to classify the various sciences (or rather the abstract or fundamental sciences, for the concrete sciences, like botany and zoology, are regarded as not yet formed, but only tending to formation) according to the varying degrees of complexity in their phenomena; so that each science depends on a knowledge of the preceding, while adding fresh data of its own. Guided by this principle, M. Comte arranges the abstract or fundamental sciences in the following hierarchical order: 1st, Mathematics, its ascending stages being Arithmetic, Geometry, Mechanics; 2nd, Astronomy (or the applications of the Law of Gravitation); 3rd, Physics, its departments being Barology or the science of weight, Thermology or the science of heat, Acoustics, Optics, and Electrology, of which Barology must come first, and Electrology last, the places of the others being more doubtful; 4th, Chemistry, divided into inorganic and organic; 5th, Physiology or Biology; 6th, Socio-

logy or Social Physics, the study of man in society, implying the determination of what constitutes personal and domestic as well as social morality. In addition to the concrete sciences, such as Meteorology, Geology, Mineralogy, Botany, and Zoology, the student will miss from the above list Logic, Psychology, and Theology,[5] omissions which are not accidental but intimately connected with Comte's views on the nature and order of knowledge. The divisions of Art and Literature, as well as of the practical applications of Science, lie altogether outside the scheme. Of these classifications generally, it may be said that, useful as is the attempt to construct them and to adapt them to the existing state of knowledge, they are never able altogether to justify themselves against hostile criticism. But this is as we might expect. As the art of discovering grows with discoveries,[6] so the art of classifying grows with the knowledge to be classified, and, consequently, neither the one nor the other can ever be regarded as perfect or complete.

Little has yet been said of what is perhaps the most interesting feature in the *Advancement of Learning* and the *De Augmentis Scientiarum*, namely, the waste spots which Bacon notes in the various fields of knowledge, as cultivated in his time. The remainder of this chapter will be occupied with examples of such "deficiencies," but they must be regarded as specimens only, and by no means exhaustive.

Speaking of the want of "a complete and universal History of Learning," and promising to set forth its argument, its method of construction, and its use, he says of the former :—

"The *argument* is no other than to inquire and collect out of the records of all time in what ages and regions of the

[5] Another science which is omitted, or rather rejected, by Comte, though its omission does not appear on the face of his classification, is Political Economy.

[6] *Nov. Org.*, book i. aph. 130.

world what particular kinds of learning and arts have flourished; their antiquities, their progresses, their migrations (for sciences migrate like nations) over the different parts of the globe; and again their decays, disappearances, and revivals. The occasion and origin of the invention of each art should likewise be observed; the manner and system of transmission, and the plan and order of study and practice. To these should be added a history of the sects, and the principal controversies in which learned men have been engaged, the calumnies to which they have been exposed, the praises and honours by which they have been rewarded; an account of the principal authors, books, schools, successions, academies, societies, colleges, orders,—in a word, everything which relates to the state of learning. Above all things (for this is the ornament and life of Civil History), I wish events to be coupled with their causes. I mean, that an account should be given of the characters of the several regions and peoples; their natural disposition, whether apt and suited to the different kinds of learning, or inapt and unsuited to them; the accidents of the times, whether adverse or propitious to science; the emulations and infusions of different religions; the enmity or partiality of laws; the eminent virtues and services of individual persons in the promotion of learning, and the like. Now all this I would have handled in a historical way, not wasting time, after the manner of critics, in praise and blame, but simply narrating the fact historically, with but slight intermixture of private judgment." When speaking of the *use* of such a history, he makes the profound remark: "For the works of St. Ambrose or St. Augustine will not make so wise a bishop or divine as a diligent examination and study of Ecclesiastical History; and the History of Learning would be of like service to learned men." [7]

[7] *De Augm.* book ii. ch. 4.

Another *desideratum*, curiously included under the head of History, is a history of mechanical arts. "But, if my judgment be of any weight, the use of History Mechanical is, of all others, the most radical and fundamental towards natural philosophy; such natural philosophy I mean as shall not vanish in the fumes of subtle or sublime speculations, but such as shall be operative to relieve the inconveniences of man's estate. For it will not only be of immediate benefit, by connecting various experiences and transferring the observations of one art to the use of others, and thereby discovering new commodities, a result which must needs follow when the experience of different arts shall fall under the observation and consideration of one man's mind; but further, it will afford a more powerful illumination for the investigation of the causes of things and for constructing the axioms of the arts, than has hitherto shone upon mankind. For like as a man's disposition is never well-known or proved till he be crossed, nor Proteus ever changed shapes till he was straitened and held fast; so nature exhibits herself more clearly under the trials and vexations of art than when left to herself." [8] In a subsequent place,[9] he proposes a catalogue of inventions, or "Inventory of the Possessions of Man," "in order that those who address themselves to the discovery of new inventions may not waste their pains upon things already discovered and extant." "This inventory," he adds, "will be more workmanlike and more serviceable too, if I add to it a list of those things which are in common opinion reputed impossible in every kind, noting, in connexion with each, what thing already exists which comes nearest in degree to that impossibility; that by the one human invention may be stimulated, and by the other it may be to a certain extent directed; and

[8] Book ii. ch. 2.

[9] Book iii. ch. 5.

that so by these optatives and potentials actives may be the more readily deduced."

One branch of Physiognomy is wanting. "For Aristotle has very ingeniously and diligently handled the structure of the body when at rest, but the structure of the body when in motion (that is the gestures of the body) he has omitted; which nevertheless are equally within the observations of art, and are of greater use. For the lineaments of the body disclose the dispositions and inclinations of the mind in general; but the motions and gestures of the countenance and the divers parts do not only so, but disclose likewise the seasons of access, and the present humour and state of the mind and will." [1]

The need of a Comparative Anatomy (which, however, seems to be limited to human anatomy) is thus noted: "Likewise in anatomical inquiries, those things which pertain to man's body in general are most diligently observed, even to curiosity and in the minutest particulars; but touching the varieties which are found in different bodies, the diligence of physicians falls short. And therefore I say that Simple Anatomy is handled most lucidly, but that Comparative Anatomy is wanting. For men inquire well of the several parts, and their consistences, figures, and collocations; but the diversities of the figure and condition of those parts in different men they observe not. Meanwhile there is no question but that the figure and structure of the inward parts is but little inferior in variety and lineaments to the outward; and that the hearts or livers or stomachs of men differ as much as their foreheads or noses or ears." A passage so remarkable on vivisection occurs in this connexion, that I should hardly be justified in omitting to direct attention to it, though I must by no means be supposed to cite it with approval. "Of that other defect in anatomy (that it has not been practised on live bodies)

[1] Book iv. ch. 1.

what need to speak? For it is a thing hateful and inhuman, and has been justly reproved by Celsus. But yet it is no less true (as was anciently noted) that many of the more subtle passages, pores, and perforations appear not in anatomical dissections, because they are closed and latent in dead bodies, though they be open and conspicuous in live ones. Wherefore, that utility may be considered as well as humanity, the anatomy of the living subject is not to be relinquished altogether, nor referred (as it was by Celsus) to the casual practices of surgery; since it may be well discharged by the dissection of beasts alive, which, notwithstanding the dissimilitude of their parts to human, may, if judiciously performed and interpreted, sufficiently satisfy this inquiry." [2]

Amongst the most far-seeing and possibly fertile of Bacon's suggestions for the reformation of science are those in which he advocates a closer union between formal and physical astronomy, and proposes (a most important idea), instead of divorcing, to connect the study of celestial with that of terrestrial phenomena. "Astronomy offers to the human intellect a victim like that which Prometheus offered in deceit to Jupiter. Prometheus, in the place of a real ox, brought to the altar the hide of an ox of great size and beauty, stuffed with straw and leaves and twigs. In like manner, astronomy presents only the exterior of the heavenly bodies (I mean the number of the stars, their positions, motions, and periods), as it were the hide of the heavens, beautiful indeed and skilfully arranged into systems; but the interior (namely the physical reasons) is wanting, out of which (with the help of astronomical hypotheses) a theory might be devised which would not merely satisfy the phenomena (of which kind many might with a little ingenuity be contrived), but which would set

[2] Book iv. ch. 2.

forth the substance, motion, and influence of the heavenly bodies as they really are. . . . . Astronomy, as it now is, is fairly enough ranked among the mathematical arts, not without some loss of dignity; seeing that, if it chose to claim its proper office, it ought rather to be accounted as the noblest part of physics. For whoever shall set aside the imaginary divorce between superlunary and sublunary things, and shall well observe the most universal appetites and passions of matter (which are powerful in both globes and make themselves felt through the universal frame of things), will obtain clear and copious information of heavenly things from those which are seen amongst us; and, on the other hand, from that which passes in the heavens he will gain no slight knowledge of some motions of the lower world as yet undiscovered. Wherefore this part of *astronomy*, which is Physical Astronomy, I pronounce deficient; giving it the name of Living Astronomy, in distinction from that stuffed ox of Prometheus, which was an ox in figure only." [3] As I have said elsewhere,[4] this passage might almost be regarded as a prediction not only of the discoveries of Newton, but of the mode in which he made them. And, though views of this kind were already beginning to be in the air, it might be maintained, not without probability, that passages such as these, so admirably expressed, so full of hope, and so rich in suggestion, had no inconsiderable share in bringing about the magnificent results achieved in the studies of astronomy and mechanics by the next generation.

An increasing number of the branches of Mixed Mathematics is foretold by Bacon in a passage where, as in some of the Aphorisms of the *Novum Organum*,[5] he shows a just appre-

[3] Book iii. ch. 4.

[4] Introduction to the *Novum Organum*, § 6.

[5] *Nov. Org*, book i. aph. 96; book ii. aph. 8.

ciation of the relations subsisting between Mathematics and Physical Science. "In Mixed Mathematics I do not now find any entire parts deficient, but I predict that hereafter there will be many more kinds of them, if men be not idle. For as Physic advances farther and farther every day, and developes new axioms, it will require fresh assistance from Mathematics in many things, and so the parts of Mixed Mathematics will become more numerous." [6]

In Book vi., he proposes the comparative study of languages. One of its uses will be to serve as a key to national characteristics. "There will be obtained in this way signs of no slight value, but well worthy of observation (which a man would hardly think perhaps), concerning the dispositions and manners of peoples and nations, drawn from their languages." [7]

The Seventh Book contains a chapter (ch. 3) on the "Georgics" or culture of the mind, an art whose province it ought to be to prescribe rules for accommodating the will of man to the pursuit of his highest good. This art must take account of the various dispositions, affections, and habits of different men, howsoever formed, and try, in virtue or in spite of them, to construct for the individual a happy and beneficent life. As to this part of moral doctrine, "when I recall the excellency thereof, I cannot but find it exceeding strange that it is not yet reduced to written inquiry."

Amongst the *desiderata* mentioned in the Eighth Book, is a Treatise on Universal Justice or the Fountains of Equity. Bacon appends a specimen of such a treatise, digested into Aphorisms, which was afterwards published in a separate form. Its object is, "by going to the fountains of justice and public expediency, to exhibit, with reference to the several provinces of law, a type and idea of justice, in comparison with which the laws of particular states and kingdoms may be tested and

[6] Book iii. ch. 6.

[7] Book vi. ch. 1.

amended." This idea had occurred to Bacon as least as early as the publication of the *Advancement of Learning* in 1605. He there says, towards the end of the Second Book :[8] "For the more public part of government, which is law, I think good to note only one deficiency; which is, that all those which have written of law have written either as philosophers or as lawyers, and none as statesmen. As for the philosophers, they make imaginary laws for imaginary commonwealths; and their discourses are as the stars, which give little light because they are so high. For the lawyers, they write, according to the states where they live, what is received law, and not what ought to be law: for the wisdom of a lawmaker is one, and of a lawyer is another. For there are in nature certain fountains of justice, whence all civil laws are derived but as streams: and, like as waters do take tinctures and tastes from the soils through which they run, so do civil laws vary according to the regions and governments where they are planted, though they proceed from the same fountains." The idea of Natural Law or a Law of Nature was by no means new. The Roman Jurists had adopted it from the Greek Philosophers. But Bacon was probably the first writer who suggested its embodiment in a code, or gave a specimen of such a code. The great work of Grotius, *De Jure Belli et Pacis*, was not published till 1625, though it may be noticed as a curious coincidence that, about the same time that Bacon was composing the Second Book of the *Advancement of Learning*, Grotius was engaged in writing the treatise, till recently unpublished, entitled *De jure prædæ*, which, in its main principles, anticipated his later work.[9]

[8] See Mr. Aldis Wright's edition, pp. 249, 250; Ellis and Spedding, vol. iii. pp. 475-6.

[9] See Mr. Pattison's article on Grotius in the last edition of the *Encyclopædia Britannica*.

In the books here under review, Bacon does not confine himself to noting the deficiencies of the sciences. He notes also the deficiencies in the then existing applications for their augmentation and distribution. Well worthy of perusal are the few paragraphs at the beginning of the second book both of the *Advancement of Learning* and of the *De Augmentis*, where he discusses the "three objects with which the works or acts of merit towards learning are conversant"—namely, "the places of learning, the books of learning, and the persons of the learned." These observations, as well as his *Advice to the King touching Sutton's Estate*,[1] may still be read with profit by all who are interested either in advancing the limits of learning or in the maintenance of a high standard of superior instruction. That "teachers of men" are as necessary in a state as "teachers of children;" that "they who stay with the baggage should have equal part with those who are in the action;" that, if the principal readers in the universities, "through the meanness of their entertainment," "take their place but in passage, it will make the mass of sciences want the chief and solid dimension, which is depth;" that "the searchers and spies of nature must have their expenses paid, or else you will never be well informed of a number of things most worthy to be known;" that Philosophy and Universality supply sap and strength to all the arts and professions; that libraries are as the shrines wherein all the relics of the ancient saints full of true virtue are preserved: these are not simply pointed and epigrammatic sentences, but they express profound truths which even now men would do well to lay to heart, and which it might be the wisdom of states to embody in their institutions.

[1] Printed in Spedding's *Letters and Life*, vol. iv. pp. 249–54, and in Spedding's *Life and Times of Bacon*, vol. i. pp. 647—654.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

CHAPTER IV.

BACON'S REFORM OF SCIENTIFIC METHOD.

PART I.

IN the history of literature, Bacon is mainly known as the writer of the *Essays*. But in the history of science, logic, and philosophy, the chief interest which attaches to his name is that of a reformer of scientific method. The Baconian reform, the Baconian method, the spirit of the Baconian philosophy, are phrases with which we are all familiar. The object of this chapter will be to explain these terms, and to show wherein the reform or new method, with which Bacon's name is associated, really consisted.

The method which obtained almost exclusively in scientific inquiries during the middle ages and up to Bacon's time is what is commonly called the Deductive method. Deduction is always an indispensable part of logical procedure, but, as it argues from ultimate premisses or general principles, which it is itself incompetent to prove, there must be some other mode of ascertaining the truth of general principles, unless we are prepared to acquiesce in their assumption on no other grounds than fancy, authority, or caprice. Induction, as far back as the time of Aristotle, if not of Socrates and Plato, was recognized by philosophers as the regular and legitimate mode of establishing principles, and that men had in practice, from the very earliest times, generalised from

particulars, or, in other words, performed inductions, however little they had been led to reflect on the logical character or justification of the process, it is needless to remark. To infer propositions of general application from particular observations (Induction), and to apply general propositions to particular cases (Deduction), are, indeed, processes so essential to thought of any kind, or at least to any thought except of the most elementary character, that man could hardly be said to possess any knowledge for himself, much less to be able to communicate it to others, till both these methods had come to be in ordinary use, It is, therefore, absurd to speak as if Bacon were the inventor of induction, great as are the obligations under which the inductive branch of logical analysis will always be to his efforts and his genius. Men have always reasoned inductively in the affairs of common life, nor has there ever been any period in the history of science so enslaved to authority, or so wedded to abstract theory, that the inductive side of inquiry has been neglected altogether. What Bacon complained of, and rightly complained of, was not that the writers and teachers of his time had no recourse to the observation of facts at all, but that they only looked out for facts in support of pre-conceived theories, or else, where authority and prejudice did not lead the way, constructed their theories on a hasty and unmethodical examination of a few facts collected at random. In either case they neglected to test or verify their generalisations, while they wasted their efforts in drawing out syllogistically long trains of elaborate conclusions, which, for aught they knew, might be vitiated by the unsoundness of the original premisses.

It was to remedy these defects that Bacon designed the second part of his *Great Instauration*, the *Novum Organum*. This work, as already stated, was never finished. The First Book consists of a number of brilliant and pregnant aphorisms,

intended to excite the reader's interest and to prepare him for the more weighty matter which is to follow. In these aphorisms, he dwells mainly on the futility of the methods of inquiry at present in use, on the necessity of a more faithful study of Nature, on the phantoms which beset the mind in its search for truth, on the causes of man's long continuance in error, and on the grounds of hope for the future progress of knowledge. In the Second Book, he sets to work to construct his own method, and, though the book abruptly ends before he has completed one quarter of his scheme, he succeeds in laying the foundations of a science for the interpretation of nature, which, rough and cumbrous as are some of the materials of which they are composed, furnish the ground-plan on which almost all subsequent workers in this department of knowledge have built. Inductive Logic, that is, the systematic analysis and arrangement of inductive evidence, as distinct from the natural induction which all men practise, is almost as much the creation of Bacon as Deductive Logic is that of Aristotle. It must, however, be acknowledged that the one left far more to be added and re-modelled by his successors than did the other.

"Man," says Bacon, "is the servant and interpreter of nature." But as the bare hand is of little use in mechanical work, so the unassisted intellect can effect little in the work of reasoning. The one requires instruments, the other rules. Rules are, indeed, supplied by the logic which is in vogue, but, as these rules lend no aid in the examination of principles, they are of more avail in establishing error than in investigating truth. He who takes the wrong road wanders the further from his goal, the further he goes. The Syllogism, the great instrument of the ordinary logic, is, from the very nature of the case, incompetent to prove the ultimate premisses from which it proceeds, and, while the truth of these

remains doubtful, we can place no confidence in the conclusions which are drawn from them. It is in vain to construct elaborate proofs of propositions depending on principles which are themselves uncertain. The only hope, therefore, of those who wish to establish knowledge on a firm basis is in a logic which shall be competent to examine these higher generalisations or first principles from which the various sciences start, that is to say, in a true induction. The language which Bacon here employs is by no means exaggerated. Of what use can it be to spin out long deductions, assuming the truth of principles which we have never examined? Suppose us to assume that all the heavenly bodies move in circles, or that herbs are stamped with signs of the diseases which they will cure, or that the so-called four elements, earth, water, air, and fire, are each denser than the other in a tenfold proportion, or that the Bible contains a perfect system of physical science, can any series of deductions, however accurate and elaborate, drawn from such premisses, possess any other merit than that of mere consistency and ingenuity? The conclusions may carry us further and further away into the mazes of error, but they cannot bring us nearer to truth. Hence, the first step in the reform of science is to review its ultimate principles, and the first condition of a scientific method is that it shall be competent to conduct such an inquiry.

Before, however, attempting to supply this want and to construct his "new instrument," the new Logic of Induction, Bacon lingers for a while over the existing condition of knowledge, points out the phantoms which obscure the vision of truth, enumerates the causes of past errors, and suggests grounds of hope for the future.

Perhaps the best known part of the *Novum Organum*, and certainly one of the most valuable parts, is the account of the "Idola Mentis Humanæ," or "phantoms of the human mind,"

which occupies Aphorisms 38—70 of Book i. "The idols and false notions which are now in possession of the human understanding, and are deeply rooted therein, not only so beset the minds of men that the entrance to truth is difficult: but, even if truth should effect an entrance, they will oppose themselves again in the very instauration of the sciences; unless, being forwarned of the danger, men fortify themselves as far as may be against their assaults" (Aph. 38). These "idols" (εἴδωλα, phantoms or spectres, and not, as they have sometimes been erroneously interpreted, false gods) are four in number, and are enumerated as "idols of the tribe" (idola tribus), "idols of the den" (idola specus), "idols of the market-place" (idola fori), and "idols of the theatre" (idola theatri). In number, they happen to correspond with the "offendicula" of Roger Bacon; namely, unworthy authority, custom, vulgar opinion, and concealment of ignorance combined with the ostentation of apparent wisdom. There is, however, little other resemblance between the "idola" and the "offendicula," and Francis Bacon is probably in no way indebted to his elder namesake for this part of his doctrine.[1]

"The Idols of the Tribe have their foundation in human nature itself, and in the very tribe or race of men. For it is a false assertion that the sense of man" (sensus humanus) "is the measure of things. On the contrary, all perceptions as well of the sense as of the mind are according to the measure of the individual and not according to the measure of the universe. And the human understanding is like a mirror unevenly disposed to receive the rays of things, which mingles its own nature with the nature of things, and so distorts and discolours it" (Aph. 41). Examples of these idols of the tribe, which, though they are common to the whole race, admit of

[1] See note on book i. aph. 38, in my edition of the *Novum Organum*.

being detected by man himself, are the tendency to feign parallels and similitudes where none exist, or, in other words, the excessive love of system, the tendency to attach greater importance to affirmative than to negative instances, the disposition to be unduly influenced by sudden and simultaneous impressions, the restless ambition to penetrate further into the nature and causes of things than the limits of the human faculties permit, the liability of the intellect to be warped by the will and affections, and the like.

"The Idols of the Den have their origin in the peculiar constitution, mental or bodily, of each individual; and also in education, habit, and accident." Examples are to be found in the affection of some men for particular sciences or kinds of speculation, in the tendency to notice differences rather than resemblances, or resemblances rather than differences, in the attachment to antiquity or novelty, in the partiality to minute or comprehensive investigations. The practical precept suggested by the last example affords a good instance both of the felicity of Bacon's language and of the sagacity of his observation. "Alternandæ sunt contemplationes istæ, et vicissim sumendæ; ut intellectus reddatur simul penetrans et capax." (These kinds of contemplation should be alternated and taken by turns; that so the understanding may be rendered at once penetrating and capacious). Aph. 57.

The Idols of the Market-Place ("Idola Fori"), which have insinuated themselves into the mind through the association of words and names with things, are, Bacon says, the most troublesome of all. They are of two kinds, being either names of supposed entities which have no real existence, or words inadequately or erroneously representing things or qualities actually existing. Of the former kind are "fortune," the "primum mobile," the "planetary orbs," and figments of that kind, which have their origin in false and idle theories. As

examples of the other division of "Idola Fori" Bacon gives "earth," "humid," "generation," "corruption," "alteration," "heavy," "light," "rare," "dense," and the like. This topic of the fallacies imposed on the intellect by the want of correspondence between words and things is followed up by Locke in the celebrated Third Book of his Essay, as well as by many recent writers, and is well worthy of the attention of every student, who is desirous of thinking accurately. "Men believe," says Bacon, "that their reason governs words; but it is also true that words react on the understanding; and this it is that has rendered philosophy and the sciences sophistical and inactive. Now words, being commonly framed and applied according to the capacity of the vulgar, follow those lines of division which are most obvious to the vulgar understanding. And whenever a more acute understanding or a more diligent observation would alter those lines to suit the true divisions of nature, words cry out against the change. Whence it comes to pass that the grand and solemn disputations of learned men often end in controversies about words and names; with which (according to the use and prudence of the mathematicians) it would be wiser to begin, and so by means of definitions reduce such disputations to order. Yet even definitions cannot cure this evil in dealing with natural and material things; since the definitions themselves consist of words, and words beget words: so that it is necessary to recur to individual instances, and those in due series and order." Even when a precise and scientific sense has been attached to a word, there is always a difficulty in securing that it shall be employed or accepted in that signification; moreover, a word has always a tendency, as time goes on, to glide by insensible degrees into another and often a very different meaning from that in which, by convention or by the operation of natural causes, it was originally employed.

The Idols of the Theatre, so called because they succeed one another like the plays on a stage, arise either from false systems of philosophy or from perverse laws of demonstration. The former division is represented by three schools of philosophers, the Rational or Sophistic, the Empiric, and the Superstitious. "The Rational school of philosophers snatches from experience a variety of common instances, neither duly ascertained nor diligently examined and weighed, and leaves all the rest to meditation and agitation of wit." It deals but little with experience, and much with speculation. Of this theorising school, Bacon, somewhat unjustly, takes his typical instance from Aristotle, "who corrupted natural philosophy by his logic." The Empirical School, "having bestowed much diligent and careful labour on a few experiments, have thence made bold to educe and construct systems; wresting all other facts in a strange fashion to conformity therewith." "To those who are daily busied with these experiments, and have infected their imagination with them, such a philosophy seems probable and all but certain; to all men else, incredible and vain." This school deals almost entirely with experiments, but the experiments are confined within so narrow a compass that the axioms which may legitimately be founded thereon are not luminous enough to throw any real light on the great problems of science. Of the Empirics the typical instances are the Alchemists, to whom, strangely enough, Bacon adds Gilbert, the founder of the sciences of electricity and magnetism. Elsewhere, he speaks of Gilbert as being so immersed in his own particular branch of study, as to have been himself turned into a magnet, and to have built a ship out of a tholepin.[2] It must be confessed that Bacon's criticisms, both of

[2] "Itaque vires magneticas non inscite introduxit Gilbertus, sed et ipse factus magnes; simio scilicet plura quam oportet ad illas trahens, et

his predecessors and his contemporaries, are often exaggerated or unfair. Last in order comes the Superstitious School, "consisting of those who out of faith and veneration mix their philosophy with theology and traditions." This "corruption of philosophy by superstition and an admixture of theology" is far more widely spread and does more harm than either of the other causes of error. "For the human understanding is obnoxious to the influence of the imagination no less than to the influence of common notions. For the contentious and sophistical kind of philosophy ensnares the understanding; but this other kind, which is fantastic and tumid and half poetical, misleads it more by flattery. For there is in man an ambition of the understanding no less than of the will, especially in high and elevated spirits. Of this kind we have among the Greeks a striking example in Pythagoras, though his superstition is of the coarser and more cumbrous character; another in Plato and his school, more dangerous and subtle. This form of evil is found also in parts of other philosophies, where there are introduced abstract forms and final causes and first causes, with the omission in most cases of causes intermediate and the like. In this matter the greatest caution should be used. For nothing is so mischievous as the apotheosis of error; and it is to be held as a very plague of the understanding, if vanity become the object of reverence (si vanis accedat veneratio). Yet in this vanity some of the moderns have with extreme levity indulged, so far as to attempt to found a system of natural philosophy on the first chapter of Genesis, on the book of Job, and other parts of the sacred writings; seeking for the dead among the living. And so much the more is this vanity to be inhibited and restrained, because from the unwholesome

navem ædificans ex scalmo." *Aditus ad Historiam Gravis et Levis.* See my note on *Nov. Org.* book i. aph. 51, ad fin.

mixture of things human and divine there arises not only a fantastic philosophy but also a heretical religion. Very meet it is therefore that we be sober-minded, and give to faith that only which is faith's." (Aph. 65).

"So much then for the mischievous authorities of systems, which are founded either on common notions, or on a few experiments, or on superstition."

"Vicious methods of demonstration are the strongholds of fallacious theories; and those methods which we have in the ordinary logic do little else than enslave the world of nature to human thoughts, and human thoughts to words. Demonstrations indeed are potentially systems of philosophy and science. For such as these are, and according as they are well or ill established, such are the systems of philosophy and the contemplations which follow. Now in the whole of the process which leads from sense and particular objects to axioms and conclusions, the demonstrations which we use are deceptive and incompetent. This process consists of four parts, and has as many faults." (Aph. 69). He then proceeds to enumerate in order the four faults, which are (1) that the senses frequently fail or deceive us; (2) that the notions derived from the impressions of the senses are confused and ill-defined; (3) that the induction commonly employed, for the purposes of generalisation, proceeds "per enumerationem simplicem," or merely by accumulating instances, instead of by methods of selection and elimination; (4) that, instead of rising gradually through the various intermediate grades of axioms to the highest axioms of all, men fly off at once to the latter and, without having sufficiently certified themselves as to their truth, proceed to deduce subordinate principles from them, as if their truth had been placed beyond doubt. On Bacon's idea of the proper mode of constituting the highest axioms by gradually ascending from the objects of sense and the lowest axioms ("axiomata

infima") through the various intermediate stages, I shall speak hereafter.

Having completed his discussion of the Idola, he proceeds (Aphs. 71—77) to enumerate the signs, five in number, of the weakness and insufficiency of the preceding philosophies. The first of these is their origin among the Greeks, whom he regards as a disputatious race, given to talking and wrangling, but inspired with no genuine love of truth. That this is an exaggerated judgment, need hardly be said. The disputatious character of the Greeks, though it may often have prevented them from arriving at truth, must at least have originated in the desire to attain it, nor, except for the tendency of the Greek race to discussion and abstract speculation, is it easy to see how modern science would ever have come into being. Another sign of the weakness of preceding systems is their lack of fruit. "For fruits and inventions are, as it were, sponsors and sureties for the truth of philosophies." "Now from all these systems of the Greeks," he adds, speaking again with some exaggeration, "and their ramifications through particular sciences, there can hardly after the lapse of so many years be adduced a single experiment which tends to relieve and advance the condition of man, and which is really due to the speculations and doctrines of philosophy." A further sign is to be found in the stationary character of existing systems. "For what is founded on nature grows and increases; while what is founded on opinion varies but increases not.[3] Had therefore those doctrines not been plainly like a plant torn up from its roots, but had they remained attached to the womb of nature and continued to draw nourishment from her, that could never

[3] "Quæ enim in natura fundata sunt, crescunt et augentur; quæ autem in opinione, variantur, non augentur." I give the original as a felicitous example of the manner in which Bacon often phrases these epigrammatic sayings.

have come about which we see now to have happened for two thousand years past: namely, that the sciences stand where they did and remain almost in the same condition; receiving no increase worthy of mention, but, on the contrary, thriving most under their first founder, and then declining. Whereas in the mechanical arts, which are founded on nature and the light of experience, we see the contrary happen, for these (as long as they are popular) are continually thriving and growing, as having in them the breath of life; at first rude, then affording convenience, afterwards ornament, and at all times advancing." (Aph. 74.)

The signs of weakness are followed by the causes of error, which are no less than fifteen in number. The first is that "of the five and twenty centuries over which the memory and learning of men extends, hardly six have been favourable to the development of the sciences. For in times no less than in regions there are wastes and deserts." Other causes of error are that, even when men have devoted themselves to learning, but little attention has been devoted to Natural Philosophy, the "great mother of the sciences;" that men have not set before themselves the true goal of knowledge, which is none other than that human life be endowed with new discoveries and powers; that they have followed wrong paths, such as the opinions of others or the ordinary logic or mere experience, instead of well-ordered and digested experience, which is the candle leading to truth; that they have been enchanted by reverence for antiquity and authority, forgetting that it is ours which is truly the old age of the world;[4] that they have

[4] "De antiquitate autem opinio, quam homines de ipsa fovent, negligens omnino est, et vix verbo ipsi congrua. Mundi enim senium et grandævitas pro antiquitate vere habenda sunt, quæ temporibus nostris tribui debent, non juniori ætati mundi, qualis apud antiquos fuit. Illa enim ætas, respectu nostri, antiqua et major; respectu mundi ipsius, nova et minor

been deterred from attempting any great and adequate enterprises in the realm of nature by pusillanimity, by superstitious fears,[5] by an exaggerated admiration for what has already been achieved, and, above all, by despondency and a tendency to regard whatever is proposed as impossible.

This last and potent cause of failure suggests to Bacon that, as "Columbus, before that wonderful voyage of his across the Atlantic, gave the reasons for his conviction that new lands and continents might be discovered besides those which were already known," so he should set forth those grounds of hope which made an instauration of the sciences appear to him probable. Of the twenty-one Grounds of Hope (occupying Aphs. 93—114), one (Aph. 95) is derived from the expectations which may be formed from a closer and holier league between the experimental and rational faculties, such as has never yet been made. "Those who have handled sciences have been either men of experiment or men of dogmas. The men of experiment are like the ant; they only collect and use; the

fuit." Aph. 84. See the notes on this Aphorism in my edition of the *Novum Organum*. In the *De Augmentis*, book i., Bacon sums up these thoughts in one short aphorism: "Sane, ut verum dicamus, Antiquitas sæculi juventus mundi." "Of living men" (says Sydney Smith in his review of Bentham's *Book of Fallacies*) "the oldest has, *cæteris paribus*, the most experience; of generations, the oldest has, *cæteris paribus*, the least experience. Our ancestors, up to the Conquest, were children in arms; chubby boys in the time of Edward the First; striplings under Elizabeth; men in the reign of Queen Anne; and we only are the white-bearded, silver-headed ancients, who have treasured up, and are prepared to profit by, all the experience which human life can supply."

[5] "Neque illud prætermittendum est, quod nacta sit philosophia naturalis per omnes ætates adversarium molestum et difficilem; superstitionem nimirum, et zelum religionis cæcum et immoderatum. Aph. 89. This "blind and immoderate zeal for religion" is exemplified in the feelings of the Greeks towards those who first explained thunder and lightning by natural causes (see Aristophanes' *Clouds*, l. 372, &c.) and of the Christian Fathers towards those who maintained the existence of Antipodes.

reasoners resemble spiders, who make cobwebs out of their own substance. But the bee takes a middle course; it gathers its material from the flowers of the garden and of the field, but transforms and digests it by a power of its own. Not unlike this is the true mode in which philosophy works. For it neither relies solely or chiefly on the powers of the mind, nor does it take the matter which it gathers from natural history and mechanical experiments, and lay it up in the memory whole, as it finds it; but it lays it up in the understanding, after it has been duly transformed and digested." Other grounds of hope are to be found in the probable construction, in the future, of a Natural History better adapted than at present to the wants of Natural Philosophy, and containing a record of experiments as well as observations (for Nature best discovers her secrets, when tortured by Art); in a larger collection of those experiments and observations which are of most use for the information of the understanding, that is to say, "*Experimenta lucifera*," experiments of light, likely to be fertile in the discovery of causes and axioms, as distinguished from "*experimenta fructifera*," experiments of fruit, which, though obviously and immediately useful, only produce particular effects; in the introduction of a new method of carrying on our experiments and observations, and advancing from one to the other, instead of that mere groping in the dark ("mera palpatio") which has hitherto been prevalent; in the formation of Tables of Discovery; and in the induction of axioms inferred from particulars "by a certain method and rule," which axioms shall, in their turn, point out the way to new particulars to be arrived at by deduction. In setting forth the Ground of Hope last mentioned, Bacon adds (Aph. 103) the words which have since been so frequently quoted in works on Scientific Method: "For our road does not lie on a level, but ascends and descends; first ascending to axioms, then descending to

works." [6] The enumeration of the Grounds of Hope naturally includes many criticisms on the methods in vogue, favourable auguries being drawn from the likelihood of their amelioration. Thus, in Aph. 104, where he protests against the prevalent habit of flying off at once from particular facts to first principles or the most general axioms of all, he insists on the importance of establishing by a careful induction a sufficient number of intermediate axioms ("axiomata media"), which are "the true and solid and living axioms, on which depend the affairs and fortunes of men." "The understanding," he adds (too much ignoring, perhaps, here as elsewhere, the office of the imagination in scientific inquiry), "must not therefore be supplied with wings, but rather hung with weights, to keep it from leaping and flying. Now this has never yet been done; when it is done, we may entertain better hopes of the sciences." Again, in Aph. 105, he emphatically condemns the method of Induction by Simple Enumeration, or mere addition of instances. "It is a childish thing; its conclusions are precarious, and exposed to peril from a single contradictory instance; and it generally decides on too small a number of facts, and on those only which are close at hand." [7] Then, after contrasting with this unscientific and faulty form the induction which he himself contemplates, which "must analyze nature by proper rejections and exclusions," he adds with a true appreciation of the difficulties of his task: "But in order to furnish this induction or demonstration well and duly for its work, very many things are to be provided which

[6] Neque enim in plano via sita est, sed ascendendo et descendendo; ascendendo primo ad axiomata, descendendo ad opera.

[7] Inductio, quæ procedit per enumerationem simplicem, res puerilis est, et precario concludit, et periculo exponitur ab instantia contradictoria, et plerumque secundum pauciora quam par est, ex his tantummodo quæ præsto sunt, pronunciat.

have never yet entered the thoughts of any mortal man; insomuch that greater labour will have to be spent on it than has hitherto been spent on the syllogism." It is verily in this new kind of induction, he says, that our chief hope lies. This portion of the *Novum Organum* is appropriately terminated by an appeal to his own example. "If there be any that despond, let them look at me, and take note that, being of all the men of my time the most occupied in affairs of state, and not of very strong health (which occasions a great loss of time), and in this course altogether a pioneer, following in no man's track nor sharing these counsels with any one, I have nevertheless, by resolutely entering on the true road and submitting my mind to things, advanced these matters, as I suppose, some little way. And then let them consider what, after the way has thus been pointed out by me, may be expected from men abounding in leisure, and from association of labours, and from successions of ages." Aph. 113.

After Bacon has thus described "the breath of hope blowing on us from that New Continent," he proceeds, before indicating "the art itself and rule of interpreting nature," to lay down certain warnings, to offer certain apologies, and to answer, by anticipation, certain doubts and objections. Of the questions which, as he conceives, might be put to him, far the most important is whether he intends his new method to be confined to the problems of natural philosophy, or contemplates its application to the other sciences as well, "logic, ethics, and politics." To this question he replies (Aph. 127): "Now I certainly mean what I have said to be understood of them all; and as the common logic, which governs by the syllogism, extends not only to natural but to all sciences; so does mine also, which proceeds by induction, embrace everything. For I form a history and tables of discovery for anger, fear, shame, and the like; for matters political, and again for the mental

operations of memory, affirmation and negation, judgment and the rest: not less than for heat and cold, or light, or vegetation, or the like." This statement should carefully be noted; for, on a hasty reading of the *Novum Organum*, it might easily be supposed that Bacon's object was confined to an instauration of what we now call the natural sciences. He here, however, explicitly tells us that his method is applicable, and intended to be applied, to the whole realm of knowledge. Nor, greatly as the illustrations from the study of external nature preponderate, are there wanting many passages in his works which show that he regarded the study of man and society as falling within the scope of his new philosophy and capable of being advanced by the application of his new method.[8] That the inductive method has, since Bacon's time, been largely and successfully applied to the treatment of these subjects hardly needs to be stated. In the earlier stages, at any rate, of what may be called the mental, moral, and social sciences, the employment of induction is now generally regarded as indispensable, and no writer on these questions, whose speculations were not based on or supported by observation, would, in this country at least, receive any attention. As I have said elsewhere,[9] "the enormous extension which the method of Induction has received in recent times by the application of a historical treatment to the subjects of law, institu-

[8] For proof of this assertion, see the notes on aph. 127, in my edition of the *Novum Organum*.

[9] See my notes on *Nov. Org.* book i. aph. 127. For a brief description of the Historical Method, I may refer the reader to my *Inductive Logic*, ch. 3 (3rd ed. pp. 200—202), and for some remarks on Mr. Mill's account of it (given in his *Logic*, book vi. ch. 10), to ch. 5, p. 246. Numerous examples of its employment will be found, amongst English writers, in the works of Sir H. Maine, Professor Max Müller, Sir J. Lubbock, Mr. Tylor, and (though, in this case, mixed up with a good deal of abstract speculation) Mr. Herbert Spencer.

tions, language, art, morals, religion, &c., has really laid the basis of a scientific study of man, which may at some future time rival in respect of certainty, while it will even transcend in interest, the scientific study of nature."

The First Book of the *Novum Organum* closes with a remarkable sentence: "We, who regard the mind, not only in respect to its own faculties, but also in its relations to things, ought to hold that the art of discovery may advance as discoveries themselves advance."[1] This sentence is as true and pregnant, as it is epigrammatic. Advances in science and in the method of science must go hand in hand. The logic adequate to the simple reasoning of early times is no longer adequate to the wants of a scientific age, when knowledge is so varied and elaborate as it has now become. Condillac undoubtedly states this position in an exaggerated form, when he says: "If the Tartars wished to make an Art of Poetry, you know well that it would be a bad one, because they have no good poets. It is just the same with the Logics which have been made before the seventeenth century."[2] There must be some scientific reasoning to analyse, before there can be an analysis of it; but it is equally true that, when such an analysis has been made, and rules laid down for discriminating between correct and incorrect reasoning, the scientific inquirer or student is furnished with guides and cautions which ought to place him on a vantage-ground as compared with his predecessors. In the last resort, indeed, all modes of reasoning may be reduced to a few very simple formulæ, which are common

[1] Neque tamen illis nihil addi posse affirmamus: sed contra, nos, qui mentem respicimus, non tantum in facultate propria sed quatenus copulatur cum rebus, artem inveniendi cum inventis adolescere posse, statuere debemus.

[2] *Histoire Moderne*, livre xx. ch. 12. For further remarks on this subject, see the last note to book i. in my edition of the *Novum Organum*.

alike to the reasonings of common life and of science; but these may be combined and applied in so infinite a variety of ways that the art of the logician can never be regarded as complete, any more than the accumulations of knowledge, real or supposed, which it is his task to test and adjudicate upon. Hence, some acquaintance with the existing condition of science is at least as indispensable to the logician as some acquaintance with the existing rules of scientific method is to the man of science.

From the prefatory remarks of Book i., Bacon passes in Book ii. to a more formal and systematic exposition of his method. The first ten Aphorisms consist mainly of general reflections on the ends of science, on the necessity of inquiring into Forms, and on the connexion between the speculative and operative branches of knowledge. In the 11th Aphorism the real business of the book begins, and this and the two next aphorisms contain the celebrated Inductive Tables which, together with the "exclusion or rejection of natures" of which an example is given in Aph. 18, constitute Bacon's principal apparatus for arriving at a knowledge of the "Form." Before proceeding any further, something must be said as to the meaning of this expression and its importance in Bacon's conception of philosophy.

In the Second Book of the *Advancement of Learning*,[3] he distinguishes between the provinces of Physic and Metaphysic, assigning to the former the inquiry into Material and Efficient Causes, and to the latter the inquiry into Formal and Final

[3] The parallel passage in the *De Augmentis* is in book iii. ch. 4. The reader, who has leisure to pursue this subject, should compare these passages, and refer to the Section (§ 8) entitled "On the meaning attached by Bacon to the word Form," in the Introduction to my edition of the *Novum Organum*.

Causes. He then proceeds to say that, as to the assignment of Formal Causes to Metaphysic, it "may seem to be nugatory and void, because of the received and inveterate opinion that the inquisition of man is not competent to find out *essential forms* or true differences, of which opinion we will take this hold; that the invention of Forms is of all other parts of knowledge the worthiest to be sought, if it be possible to be found. As for the possibility, they are ill discoverers that think there is no land when they can see nothing but sea. But it is manifest that Plato in his opinion of Ideas, as one that had a wit of elevation situate as upon a cliff,[4] did descry that forms were the true object of knowledge; but lost the real fruit of his opinion, by considering of forms as absolutely abstracted from matter, and not confined and determined by matter, and so turning his opinion upon Theology, wherewith all his natural philosophy is infected. But if any man shall keep a continual, watchful, and severe eye upon action, operation, and the use of knowledge, he may advise and take notice what are the forms, the disclosures whereof are fruitful and important to the state of man." The Forms of Substances, indeed, "are so perplexed, as they are not to be inquired," or, as is added in the *De Augmentis*, "they should be laid aside for a time, and resumed after the forms of a more simple nature have been duly sifted and discovered." To inquire into the forms of substances before we have inquired into the forms of a more simple nature is no more "possible or to purpose" than "to seek in gross the forms of those sounds which make words, which by composition and transposition of letters are infinite." "But on the other side to inquire the form of those sounds or voices which make simple letters is easily comprehensible: and

[4] This clause is better stated in the parallel passage of the *De Augmentis*: "But it is manifest that Plato, a man of a sublime genius, who took a view of everything as from a high rock," &c.

being known induceth and manifesteth the forms of all words, which consist and are compounded of them. In the same manner to inquire the form of a lion, of an oak, of gold; nay, of water, of air, is a vain pursuit: but to inquire the forms of sense, of voluntary motion, of vegetation, of colours, of gravity and levity, of density, of tenuity, of heat, of cold, and all other natures and qualities, which, like an alphabet, are not many, and of which the essences (upheld by matter) of all creatures do consist; to inquire, I say, the true forms of these, is that part of metaphysic which we now define of." The first business of science, then, is to enquire into the "forms of simple natures;" when these have been ascertained, but not till then, we may hope to give an account of the vast multiplicity of objects with which we are surrounded. Just as a word is composed of letters, so a substance is composed of qualities, and, when we have resolved the substance into its qualities, we may give a full explanation of it, and can only give a full explanation of it, by assigning the "form" of each of the qualities of which it is composed. Similarly, in the operative branch of knowledge, we may produce a substance by superinducing, one after another, the various qualities which constitute it, or we may transform one substance into another, by eliminating one or more qualities and substituting one or more new ones. (See *Nov. Org.* book ii. aphs. 1—5.)

The discovery of the "Form," then, being of such primary importance in Bacon's conception of science, we must ask: What is a Form, and How is the Form of a Simple Nature to be discovered?

The word "Form," as employed by Bacon, is undoubtedly connected with the Formal Cause or Essence (*τὸ εἶδος* or *τὸ τί ἦν εἶναι* or *ἡ οὐσία*) of Aristotle. But we are rather concerned with the way in which he himself uses the word, than with the historical antecedents which led him thus to use it. Now,

after a careful consideration of the various passages in which it occurs, I have arrived at the conclusion that they may all be ranged under two classes. In one of these, the word "form" may always be replaced by words like essence, differentia, definition, &c.; in the other by words like law, cause, &c.[5] By form, in the sense of essence, is to be understood the aggregate of independent and underived (or, as we might call them, *primary*[6]) attributes, from which all the other attributes appertaining to the class, substance, or quality, are derived, as effects from causes. By form, in the other sense, is to be understood the law of the developement or manifestation or production of any given quality or body. And, if we take into account the pre-existing conditions as well as the law of their developement, we obtain the conception of "cause" in its fullest extent.

"Now, is it possible to reconcile or bring into any connexion these two apparently divergent meanings?[7] The form, we have seen, is, according to the one conception, the aggregate of the primary or underived attributes from which the other attributes are derived, as effects from causes. According to the other conception, it is the law according to which the phenomenon in question is developed out of pre-existing conditions, or, taking into account the conditions, it is, in brief, its cause. But practically (and the practical interest is, with

[5] There is one passage (*Nov. Org.* book i. aph. 75), in which the two meanings are brought together: "Hinc opinio, quod formæ sive veræ rerum differentiæ (quæ revera sunt leges actus puri) inventu impossibiles sint, et ultra hominem."

[6] I am not here employing the word "primary" with any reference to the distinction, rendered familiar by Locke and other writers, between the so-called "primary and secondary qualities of matter." I am simply employing it in the sense of underived or having no assignable cause.

[7] I am quoting here, as I have also done in some portions of the preceding paragraph, from § 8 of the Introduction to my Edition of the *Novum Organum*.

Bacon, always supreme), these two conceptions may, if we take a sufficiently sanguine view of human power, be regarded as leading to the same result. Given the aggregate of primary and underived attributes, and we are able to produce the phenomon, or rather it follows as a matter of course. Given the pre-existing conditions and the law of their developement, and (on the important assumption that we are able to further their developement) we are ourselves able to produce the effect. Thus the knowledge of the essence and the knowledge of the cause are, for all practical purposes, the same. If, to take Bacon's instances, we know that heat consists in a certain kind of motion, or whiteness in a certain juxtaposition of particles, we are already acquainted with the law of its developement or cause of its production. Or, to take Lasalle's instance of Form, if we are acquainted with Newton's analysis of a white ray of light into the several coloured rays of which it is composed, it is indifferent whether we speak of these rays as constituting (=being the essence of) whiteness, or as producing (=being the cause of) whiteness. And, as substances or concrete bodies were, according to Bacon's conception, 'formæ copulatæ,' or combinations of certain 'simple natures,' a knowledge of the 'essence' would, in their case also, be equivalent to a knowledge of the 'cause.'"

In modern scientific terminology, therefore, we may usually replace the Baconian question "What is the Form" by the question "What is the Cause."

We have now to consider the peculiar method by which Bacon conceived that the Form, essential nature, cause, or law, was to be ascertained.

He is never weary of dwelling on the insufficiency of the Inductio per Enumerationem Simplicem, or method of induction then in vogue. This method consisted in merely accumulating instances presenting the phenomenon in question, without

following any rule of selection. If any other circumstance were found invariably to accompany the phenomenon, this circumstance was set down, without further examination, as its cause, or effect, or at least as connected with it in the way of causation. An invariable concomitance of two or more qualities within the range of observation undoubtedly affords a presumption of causation, but this presumption may often be very slight and easily dissipated by further experience. Thus, a native of the North of Europe might, some centuries ago, have concluded to his own satisfaction that all men are white, or a native of Central Africa that all men are black. Instead of this hasty and hap-hazard kind of induction, it is the peculiar merit of Bacon to have conceived, and to a certain extent to have elaborated, a regular and scientific method, proceeding by way of elimination, and thus carrying up an effect to its cause or following a cause into its effects by a chain of demonstrative reasoning. This method he calls the Method of Exclusions or Rejections, and it is in this device that he conceives the peculiar value and originality of his logical system to consist.[8] Some of the assumptions on which the Method of Exclusions rests would now unquestionably be rejected as false or doubtful, but, when taken along with its adjuncts, it must none the less be regarded as a monument of Bacon's genius as well as the beginning of a new era in the history of the methods of scientific inquiry.

We have seen that Bacon conceived it possible, by means of analysis, to arrive at a number of qualities or "simple natures," standing in the same relation to the complex substances which they are supposed to constitute as the letters of an alphabet to

[8] At Inductio, quæ ad inventionem et demonstrationem scientiarum et artium erit utilis, naturam separare debet, per rejectiones et exclusiones debitas; ac deinde, post negativas tot quot sufficiunt, super affirmativas concludere. *Nov. Org.* book i. aph. 105.

the various words which occur in a language. These "simple natures" he regarded as limited in number, and, apparently, as all capable of being ultimately ascertained. Now some of these "simple natures," he assumed, depend upon others, that is to say, are effects or modes of others, and, if we can only ascertain what these others are on which they depend, may be produced by means of them. The "simple nature" on which another "simple nature" depends (for it is always assumed that there is only one such nature) is its Form. To discover the Form, we have only to go through the list of "simple natures" (supposed to be exhaustive), and find reasons, grounded on observations or experiments or on a comparison of observations or of experiments or of both, for setting aside first one, and then another, till at last one "simple nature" only is *left*. This will be the Form of which we are in search. Or if, instead of excluding all the "simple natures" but one, we can only narrow them down to a few, the Form will have subsequently to be sought amongst these few, or, at least, we must content ourselves with the knowledge that it is to be found somewhere or other amongst them.

This method (which we must recollect Bacon regarded as an ideal, not likely for some time to be attained [9]) is open to many obvious objections. In the first place, there must be some one, if not more, of the "simple natures" which is ultimate, and therefore has no "Form" outside of itself. To this objection, however, Bacon would probably have replied that the ultimate character of such a "nature" would be ascertained by a due use of his method; for, if all the other "simple natures" were excluded, it would follow that there was no external "Form" or cause of the nature in question. And it may have been for this reason that, in writing the *Novum Organum*, he substi-

[9] Neque vero ipsa exclusiva ullo modo perfecta est, neque adeo esse potest sub initiis. *Nov. Org.* book ii. aph. 19.

tuted for motion, the Form of which he had proposed to himself for enquiry in his earlier essay the Filum Labyrinthi, and which he had now perhaps come to regard as an ultimate fact, the example of Heat, which, as we shall presently see, he resolved into a particular kind of motion. Another objection, not so easily answered, is that Bacon always assumes that each "simple nature" has only one form. Wherever the word "form" can be replaced by "essence," this assumption is justified; but, wherever it is more correctly replaced by "cause," the assumption is open to the objection, taken by Mr. Mill, that an effect is sometimes due to one set of conditions and sometimes to another. Thus, to employ the technical language of Mr. Mill's logic, Bacon ignores the consideration of the Plurality of Causes. A third objection (and, perhaps, the most obvious of all) is this. Why take the trouble to go through the whole list of "simple natures," elaborately rejecting one after another in turn, when we can often take the much shorter route of establishing, by the various subsidiary methods which he himself suggests, a positive connexion between some one phenomenon or "nature" and another? As I have said elsewhere,[1] if the connexion between two phenomena or "natures" satisfies all the requirements of the Inductive Methods as now ordinarily stated (and we may regard Bacon as approximately formulating these Methods in the early part of the Second Book[2]), we are surely justified, without going through any "exclusion" of other natures, in affirming a causal relation between them. On the other hand, however large the number of "natures" which we can succeed in excluding, we can hardly ever be certain, in the present state of knowledge or any which we are likely to attain, that we have excluded all but one. And, even supposing we were able to attain this certainty, how

[1] See § 9 of the Introduction to my Edition of the *Novum Organum*.
[2] See especially Aph. 15.

do we know, unless we have some positive evidence, that the remaining nature is the cause or "form" of the given nature? Might they not both be, so far as our knowledge reaches, ultimate facts of nature, uniformities of co-existence, like Inertia and Gravity? Or lastly, might not the given nature be the form of the other, instead of the reverse?

The apparatus for conducting the Method of Exclusions is of far more importance in the history of Inductive Logic than is that method itself, and it is remarkable that it is quite as applicable to obtaining positive as to obtaining negative results.[3] This apparatus consists of certain "Tables" and a comparison of the results therein contained. In the First Table (Aph. 11), taking heat as his example of the "nature" whose Form is to be found, he brings together, or rather attempts to bring together, instances of all the known circumstances, however dissimilar in other respects, under which heat presents itself. Some of the "instances agreeing in the nature of heat" (Instantiæ convenientes in natura calidi) are of the most bizarre kind, and there is a confusion throughout between substances which excite in our organs a sensation of heat and those which are themselves actually hot. But yet the principle on which these instances are collected is a thoroughly sound one. If the investigator can succeed in bringing together instances so numerous and various, that, in addition to the given "nature," they have only one other circumstance in common, that circumstance may be regarded with considerable probability as connected by causation with

[3] In Aph. 15 he actually gives a rule (or rules) for obtaining from the "Tables" an immediate and positive result. "Facta autem comparentia, in opere ponenda est ipsa Inductio. Invenienda est enim, super comparentiam omnium et singularum instantiarum, natura talis, quæ cum natura data perpetuo adsit, absit, atque crescat, et decrescat." But he at once arrests himself, as I shall presently point out in the Text, and then proceeds in the next Aphorism to throw the rules into a negative form.

the given nature, and if it be sometimes found to precede the appearance of the given nature, while the given nature is never found to precede it, this circumstance may with considerable probability be regarded as the cause of which the given nature is the effect. In fact, the conditions will have fulfilled the requirements of Mill's Method of Agreement.[4]

In the Second Table (Aph. 12), he collects instances approximating closely in other respects to some one or other of the instances in the First Table, but not presenting the phenomenon of Heat[5] (Instantiæ in proximo, quæ privantur natura Calidi). Thus, to the rays of the sun, which are hot, are opposed the rays of the moon, which are not hot, and are supposed at times to be cold; to boiling liquids are opposed liquids in their ordinary condition. Here again, if, by a judicious selection of instances, an example in the Table of Agreement and a corresponding example in the Table of Privation could be found so related as to have every circumstance in common, except the presence of heat along with some other circumstance in the former case, and the absence of heat along with the absence of that other circumstance in the latter case, we might conclude (not probably merely, but with certainty) that heat and this other circumstance were related to each other as cause (or at least as a necessary part of the cause) and effect. In other words, the conditions would have satisfied the requirements of the method of Difference. A negative result might, however, be attained on far less stringent conditions. Thus, suppose that we were led by the heat of the solar rays to suspect that

[4] For an account of this and the other inductive methods here mentioned, see Mill's *Logic*, book iii., or my *Inductive Logic*, ch. 3.

[5] It must, of course, be recollected that, in Bacon's day, Heat and Cold were regarded as distinct and opposed qualities, not as different degrees of the same quality, or, as we should now say, different degrees of temperature. By "hot" Bacon means a temperature exceeding the average temperature of the human body.

light was the cause of heat, the observation of the lunar rays would at once enable us to eliminate, "exclude," or "reject" this Form; for we should have an instance where the supposed cause was present, but where its supposed effects did not follow.

In the Third Table (Aph. 13), there are brought together instances of different degrees of the given nature (Tabula Graduum sive Comparativæ in Calido), whether exhibited in the same or different subjects. If some other phenomenon could be discovered which increased and diminished proportionately with the increase and diminution of heat, that phenomenon would be the cause or the effect of heat, or, at least, causally connected with it in some way or other, and the conditions would thus conform to the requirements of Mill's Method of Concomitant Variations. If it could further be shown that this phenomenon and heat were the *only* circumstances which varied concurrently, then the phenomenon would be proved, not merely to be causally connected with heat, but to be either the cause or the effect of it.[6]

With regard both to this and the two former Tables, it must be carefully borne in mind that I am stating the conditions under which we should now feel justified in drawing certain conclusions from them, and not either the precise conditions or the precise conclusions which Bacon himself formulated.

It is, however, remarkable that, no sooner are the Tables completed, than Bacon goes on to say (Aph. 15) that, "on the appearance of all and singular the instances therein contained, we must find a nature of such a kind as to be always present, absent, and increasing and decreasing with the given nature." Were the two former of these conditions *both* fulfilled, namely, invariable concomitance of both presence and

[6] The conditions would, in this case, conform to the requirements of the Rider to the Canon of Concomitant Variations, given in my *Inductive Logic*, 3rd ed., p. 182.

absence, the case would satisfy the requirements of Mill's Joint Method of Agreement and Difference, and not only should we be able to exclude the imperfection of proof arising from Plurality of Causes (which attaches to a mere concomitance of presence), but, having established that one of the phenomena was *a* cause of the other, we should know moreover that it was *the only* cause.[7]

Having, however, suggested this positive method of dealing with the Tables, Bacon is shy of pursuing it, and recurs at once to his favourite idea of employing a series of "exclusions" or "rejections." "To arrive immediately at a knowledge of forms by mere affirmation is suitable to the intelligence of God (the creator of Forms) or perchance to angels, but it is certainly far above the power of man, to whom it is only granted to proceed first by negatives, and in the last place to end in affirmatives, after every manner of exclusion." He then proceeds (Aph. 16) to state the precise manner in which the Method of Exclusions is to be applied. "The first work of true induction (as far as regards the discovery of forms) is the rejection or exclusion of the several natures which are not found in some instance where the given nature is present; or are found in some instance where the given nature is absent; or are found to increase in some instance where the given nature decreases, or to decrease where the given nature increases." Of these grounds of rejection it may be remarked that, owing to the possibility of a Plurality of Causes, the "given nature" might be present without the other nature, or might increase while the other nature was decreasing, even though this last was one of the causes capable of producing it. Hence a "rejection" on either of these grounds might be unwarranted.

[7] See Mill's *Logic* on the Joint Method of Agreement and Difference, or my *Inductive Logic* on the Double Method of Agreement, as I prefer to call this method.

On either of the two other grounds, inasmuch as a cause must always produce its effect, a rejection would be warranted. "After the rejection and exclusion has been duly made," Bacon adds, "there will remain at the bottom, inasmuch as all the volatile opinions will vanish into smoke, a Form affirmative, solid, and true, and well defined." This, it may be repeated, could only be the case, if all possible causes had been considered, and the rejection had been so exhaustive, that only one cause remained,—conditions which it is almost impossible to fulfil. Well then might Bacon confess that, though his method was soon described, the way itself was long and intricate (Aph. 16), and that, for the present at least, he must also employ, or rather employ as auxiliary and preparatory to it, other aids for the understanding (Aphs. 19. 21).

Before, however, describing these other aids, he hazards a hypothesis (Aph. 20) on the Form of Heat, based on the materials collected in the Tables. This "giving reins to the Understanding, or First Vintage" (permissio intellectus or vindemiatio prima), must be regarded as a sort of parenthesis, inserted, by way of encouragement and relief, during the conduct of the more stringent method of Exclusions with its various aids. It is remarkable not only on account of its result, but also as seeming to afford an example of that very process of "flying off from sense and particulars to the widest generalizations," which Bacon himself condemns in the First Book.[8] It must be borne in mind, however, that the mental habit which he condemns is rather that of acquiescing too readily and confidently in wide generalizations, when formed,

[8] See *Nov. Org.* book i. aph. 19. On Bacon's attitude towards the use of Hypothesis, as well as on the general question of the employment of Hypotheses in science, the reader may consult my notes on *Nov. Org.* book i. aphs. 19, 106, and on book ii. aph. 20, ad init. The relation of Hypothesis to Induction and the conditions of a legitimate hypothesis are discussed in my *Inductive Logic*, 3rd ed., pp. 95—121.

than that of forming them, and, moreover, that the hypothesis started in ii. 20 is founded on what Bacon himself, at all events, regarded as a wide basis of facts. As is well exemplified in the present instance, a hypothesis, provided we recollect that it is merely a hypothesis and do not, without rigorous investigation, accept it as an established truth, may often be the best step that we can take in the existing condition of a science, and it always has the effect, while still open to discussion, of stimulating inquiry and directing its course. "The fantastic character," as I have said elsewhere, "of the Ancient Physics was due far less to an exuberant imagination than to a defective sense of evidence. And the true remedy was to insist on the necessity of verification rather than on the suppression of hypothesis."

The result of Bacon's "First Vintage" is remarkable in the history of science. Anticipating the theory of Heat now generally accepted, he defines it as "a motion, expansive, restrained, and striving amongst the smaller particles of bodies."[9] Even the modern theory as to the undulatory character of this motion seems to be anticipated in the following passage, which is quoted with approbation by Professor Tyndall: "The third specific difference is this, that heat is a motion of expansion, not uniformly of the whole body together, but in its ultimate particles; and at the same time checked, repelled, and beaten back, so that the particles acquire a motion alternative, perpetually quivering, striving and struggling, and irritated by repercussion, whence springs the fury of fire and heat."[1] That there are some fanciful and superficial ideas implied in Bacon's account of Heat there can be no doubt, but it is surely a striking testimony to his genius that,

[9] Calor est motus expansivus, cohibitus, et nitens per partes minores.

[1] See Tyndall's *Heat a Mode of Motion*, Appendix to ch. 2, and cp. with Bacon's account § 339 of the same work (3rd ed.).

in his main conception of Heat as an expansive and oscillatory motion amongst the minute particles of matter, he should have anticipated the precise conclusion at which, after the predominance, for a long time, of a different theory, the most eminent physicists have at length arrived.

In the 21st Aphorism, having completed the Tables and given an example of the Method of Exclusion, and having, moreover, gathered the first vintage, he proceeds to describe "the remaining helps of the understanding, as they promote the interpretation of nature and a true and perfect induction." "The helps" are nine altogether, and are intended as subsidiary to the Method of Exclusions, for the purposes of which the Tables alone are not supposed to be sufficient. It is not necessary for me even to enumerate these helps, but I may note that the seventh was to be the Deduction to Practice (Deductio ad Praxin) or the application of general axioms, arrived at by induction, to the needs of practical life, or, as Bacon puts it, it was to be "of that which is in relation to Man." The only "help" which Bacon describes (the description of the rest he deferred to a more convenient season which he never found) is the "Prerogatives of Instances" (Prærogativæ Instantiarum). These are so called from the "Tribus Prærogativa," which, being selected by lot, voted first in the "Comitia Tributa" of the Romans, and thus not only afforded an indication of the mode in which the other tribes were likely to vote, but also frequently exercised a considerable influence on their decision. They are, as Sir John Hirschel[2] says, "characteristic phenomena, selected from the great miscellaneous mass of facts which occur in nature, and which, by their number, indistinctness, and complication, tend rather to confuse than to

[2] See Herschel's *Discourse on the Study of Natural Philosophy*, § 190. Sir John Herschel gives some excellent illustrations of some of the more important of the Prerogative Instances. See §§ 190—200.

direct the mind in its search for causes and general heads of induction. Phenomena so selected on account of some peculiarly forcible way in which they strike the reason, and impress us with a kind of sense of causation or a particular aptitude for generalization, Bacon considers, and justly, as holding a kind of prerogative dignity, and claiming our first and especial attention in physical inquiries."

Some of the phrases by which Bacon designates his prerogative instances, such as crucial instances, glaring instances, clandestine instances, have become household words. I shall give a brief description of a few of the prerogative instances, selected on account either of their historical or of their logical interest.

Solitary Instances (Aph. 22) are "such as exhibit the nature under investigation in subjects which have nothing in common with other subjects except that nature; or again such as do not exhibit the nature under investigation in subjects which are in all respects similar to other subjects, except in the fact of not having that nature." "For it is clear," he adds, "that such instances cut off many long circuits, and accelerate and strengthen the process of exclusion; so that a few of them are as good as many." It is curious, and a striking example of Bacon's sagacity, that the two divisions of the "instantiæ solitariæ" correspond respectively with Mill's Methods of Agreement and Difference. Nor is he less happy in his illustration of at least the first division than in his rule. "If the inquiry," he says, "be into the nature of Colour, Solitary Instances are to be found in prisms, or crystalline gems, which show colours not only in themselves, but externally on a wall; also in dews, &c. For these have nothing in common with the colours fixed in flowers, coloured gems, metals, various kinds of wood, &c., except colour itself. From which we easily gather that colour is nothing more than a modification of the image of light received on the object, re-

sulting in the former case from the different degrees of incidence, in the latter, from the various textures and configurations of the body. It was by means of these very examples that Newton afterwards discovered the composition of light."

Travelling Instances (Instantiæ Migrantes: Aph. 23) are such as exhibit the nature under investigation in the act of travelling from one point to another: namely, in the process of being produced when it did not previously exist, or on the other hand of disappearing when it existed before; or, lastly, in passing towards increase or decrease. It is plain that this Instance includes the Method of Concomitant Variations, but an instance exhibiting a nature which "travels to generation or privation," that s to say, which, not having existed before, is produced, or which, having existed before, vanishes, falls under the head of the Method of Difference. One of Bacon's examples is paper "which is white when dry, but when wetted (that is, when air is excluded and water introduced) is less white and approaches nearer to being transparent." "In reading this," says Sir John Herschel, "and many other examples in the *Novum Organum*, one would almost suppose (had it been written) that its author had taken them from Newton's *Optics*."

Glaring, Conspicuous, or *Striking Instances* (Instantiæ Ostensivæ or Elucescentiæ: Aph. 24) are such as exhibit the nature under investigation, as it were "naked and standing by itself, and also in its exaltation or highest degree of power; as being disenthralled and freed from all impediments, or at any rate by virtue of its strength dominant over, suppressing, and coercing them." A happily selected example is the Thermometer ("vitrum calendare aëris," then a recent invention), as exhibiting, in a striking form, the expansive power of heat. The Barometer (which was not known in Bacon's time, having been invented by Torricelli in 1643) affords an equally "strik-

ing" or "glaring" instance of the weight of the atmosphere. The circumstance which conceals the weight of the atmosphere in ordinary cases, namely, the pressure of it in all directions, being entirely removed, that weight produces its full effect, and sustains the whole column of mercury in the tube. Sir John Herschel cites an example of a glaring instance, which, besides being peculiarly interesting, possesses great historical importance. "The laws of crystallography were obscure, and its causes still more so, till Haüy fortunately dropped a beautiful crystal of calcareous spar on a stone pavement and broke it. In piecing together the fragments, he observed their facets not to correspond with those of the crystal in its entire state, but to belong to another form; and, following out the hint offered by a 'glaring instance' thus casually obtruded on his notice, he discovered the beautiful laws of the cleavage and the primitive forms of minerals."

Clandestine Instances, or Instances of the Twilight, as they are also quaintly called (Instantiæ Clandestinæ, quas etiam Instantias Crepusculi appellare consuevimus: Aph. 25), are the opposite of Glaring Instances, being such as exhibit the nature under investigation "in its lowest degree of power, and as it were in its cradle and rudiments, striving indeed and making a sort of first trial, but latent under and subjected by a contrary nature." "Such instances, however," he adds, "are of very great service for the discovery of forms; because, as Glaring Instances lead easily to *differentiæ*, so Clandestine Instances are the best guides to *genera*." These instances, in fact, being on the extreme border of a class or phenomenon, serve to determine its range, just as the glaring instances, by exhibiting a property in its most striking form, serve to direct attention to its most characteristic features. Here again Bacon himself furnishes an excellent example, namely, cohesion in the case of fluids. Zoophytes would furnish a clandestine

instance of animal life; children and some of the lower animals of intelligence; barter amongst savages of commerce; and so on.

Collective Instances (Instantiæ Constitutivæ: Aph. 26) are really minor inductions, grouping together a number of individual facts. They are those "axiomata infima," or axioms of the lowest degree of generalisation, which Bacon regarded as lying at the base of the inductive pyramid. Bacon derives his principal examples from the faculty of memory and the sense of taste. But some of the examples proposed by Sir John Herschel[3] will probably afford more interest to the reader. "The parabolic form, assumed by a jet of water spouted from a round hole, is a *collective instance* of the velocities and directions of the motions of all the particles which compose it *seen at once*, thus leading us, without trouble, to recognize the law of the motion of a projectile. Again, the beautiful figures, exhibited by and strewed on regular plates of glass or metal set in vibration, are collective instances of an infinite number of points which remain at rest while the remainder of the plate vibrates; and, in consequence, afford us, as it were, a sight of the law which regulates their arrangement and sequence throughout the whole surface. . . . . Of such collective instances as these, it is easy to see the importance, and its reason. They lead us to a general law by an induction which offers itself spontaneously, and thus furnish advanced points in our inquiries; and, when we start from these, already 'a thousand steps are lost.'" Turning to astronomy, "a fine example of a collective instance is that of the system of Jupiter or Saturn with its satellites. We have here, in miniature, and seen at one view, a system similar to that of the planets about the sun; of which, from the circumstance of our being involved in it, and unfavourably situated for seeing

[3] *Discourse on the Study of Natural Philosophy*, §§ 194-5.

it otherwise than in detail, we are incapacitated from forming a general idea but by slow progressive efforts of reason. Accordingly, the contemplation of the *circumjovial planets* (as they were called) most materially assisted in securing the admission of the Copernican system."

Conformable or *Parallel Instances* (Instantiæ Conformes: Aph. 27) are such as exhibit similitudes in objects or qualities which are in many other respects dissimilar. They are, in fact, Analogies. Bacon offers, amongst other examples, a looking-glass and the eye; the workmanship of the ear and places returning an echo; the roots and branches of trees; the fins of fishes, the feet of quadrupeds, and the feet and wings of birds. Professor Playfair gives the telescope and microscope, in the works of art, as compared with the eye, in the works of nature; basaltic rocks and the lava thrown out from volcanoes; the valves in blood-vessels and the valves used in hydraulic engines for the purpose of preventing the counter-current of a fluid, by the observation of which analogy Harvey was led to the discovery of the circulation of the blood. "It is," I have said in one of my notes to this Aphorism, "by the bold use of analogies of this kind that modern physicists have been able to trace the correlations of the various physical forces; that modern philologists have been able to refer to the same families, languages of apparently the most dissimilar character; and that modern jurists and moralists have detected in laws, institutions, customs, and feelings amongst the most widely scattered races and at the most various stages of civilization a common origin and a common meaning. Though the strict use of logical method is indispensable to demonstration and verification, it is the observation of analogies, and those often very remote ones, that generally sets us on the track of great discoveries."

Singular or *Monadic Instances* (Instantiæ Monodicæ, or, as

it should be written, Monadicæ, Irregulares, sive Heteroclitæ: Aph. 28) are such as exhibit phenomena "which seem to be out of the course (extravagantia) and broken off from the usual order of nature, and not agreeing with other" phenomena "of the same kind." Examples given by Bacon are the sun and moon among stars (we must recollect that his astronomical views lagged far behind those of many of his contemporaries, who would rather have found amongst the other stars parallel instances to the sun and moon than have ranked these as singular instances); the magnet amongst stones; quicksilver amongst metals; the scent of hounds amongst kinds of smell; the letter S among letters, "on account of its easy combination with consonants, sometimes with two, sometimes even with three." In external nature, we might adduce, as additional examples of Monadic Instances, Comets, Double Stars, the occasional crescent-shape of Venus, of Mercury, and of the Moon, Earthquakes, Volcanoes, Cyclones; in law, Gavelkind and Borough English; in moral sentiment, Suttee, Duelling, the Levirate, Codes of Honour such as those which obtain amongst schoolboys or particular professions. Some of Bacon's remarks on this class of instances are highly just and philosophical. "The use of Singular Instances is the same as that of the Clandestine Instances, namely, to unite and extend the limits of nature, for the purpose of discovering genera or common natures, to be afterwards limited by true differences. For we are not to desist from inquiry, till the properties and qualities which are found in such things as may be taken for marvels of nature be reduced and comprehended under some Form or fixed Law; so that all the irregularity or singularity shall be found to depend on some common Form, and the marvel shall turn out to be only in the precise differences, and the degree, and the rare concurrence, and not in the species itself: whereas now the thoughts of men go no further than

to regard such things as the secrets and mighty works of nature, and as it were uncaused, and as exceptions to general rules." These reflections show a firm belief in the universality of Causation, and a persuasion that all so-called exceptions admit of some explanation in conformity with the general laws of nature.

Passing over several other Instances, we come in the 36th Aphorism to what are far the most famous of all Bacon's Prærogativæ Instantiarum, namely, *Crucial Instances* (Instantiæ Crucis). A "crucial instance" has become a household word in the English language, and is, perhaps, far more widely used than any other technical term of Inductive Logic. According to the metaphor, there are two or more ways before us, and the observation or experiment in question acts as a "guide-post" (crux) in determining us which to take. There being two or more rival hypotheses, which equally well accord with the facts hitherto observed, we try to think of some decisive experiment or observation, which, by according with one of the theories, and that only, will enable us summarily to reject the others. "When," says Bacon, "in the investigation of any nature the understanding is so balanced as to be uncertain to which of two or more natures the cause of the nature in question should be assigned, on account of the frequent and ordinary concurrence of many natures" (or, in other words, on account of the difficulty of disentangling from the mass of antecedents the one which stands in the relation of cause to the given effect), "Instances of the Guide-post show the union of one of the natures with the nature in question to be sure and indissoluble, of the other to be varied and separable; and thus the question is decided, and the former nature is admitted as the cause, while the latter is dismissed and rejected. Therefore, such instances afford very great light, and are of high authority; so that the course of in-

terpretation sometimes ends in them and is completed by them."

In a classification of logical methods, crucial instances may be regarded as applications of the Method of Difference. All other circumstances being the same, the appearance or disappearance, the existence or non-existence of some one circumstance, or combination of circumstances, enables us to determine the question at issue.

The simplest and most familiar examples, perhaps, of the employment of crucial instances are to be found in the processes of chemistry, as where we employ a *test* for the purpose of determining the nature of a particular substance or of detecting the presence of a particular poison. In daily life, too, we are constantly employing crucial instances, as where we form plans for testing a man's veracity or his honesty or his punctuality or the thoroughness of his work. A celebrated historical example of the employment of a crucial instance is that by which Pascal demonstrated the weight of the atmosphere. The phenomenon to be explained was the fact that water will not rise above a certain height in the common pump or mercury above a certain height in the barometer, which instrument had already been invented by Torricelli. Of this fact there were two explanations: one that nature's abhorrence of a vacuum (the old mode of accounting for a liquid rising by suction in a pipe) was not sufficient to act beyond a certain point; the other, suggested by Torricelli, who had recently died, that the column of water or mercury answers to the super-incumbent pressure of a column of the atmosphere of equal weight. The fact that Torricelli's barometric column varied in height from day to day afforded strong evidence of the supposition that it measured the weight of the atmosphere, but Torricelli's death arrested the progress of his experiments. [illegible] were taken up by Pascal, who [illegible]

were the true explanation, the height of the barometric column must vary with the various degrees of elevation above the earth's surface, sinking lower and lower as the height attained is greater. On the other hand, the extent of nature's abhorrence of a vacuum could hardly be affected by the circumstance of the experiment taking place on a mountain or a plain. Accordingly, on the 19th of September, 1648, Pascal, who could not himself undertake the task, caused a decisive experiment to be made on the Puy de Dôme in Auvergne. In the presence of numbers of persons, the barometer was carried up the mountain, and the column was found gradually to descend as the ascent was made. Moreover, the reading of the barometer at the top of the mountain was found to differ considerably from the simultaneous reading of a similar instrument which had been retained in a garden at Clermont. Nothing could be more satisfactory than this *crucial instance*, which Pascal himself verified by taking the barometer up the tower of St. Jacques de la Boucherie and other high buildings at Paris.

Bacon's own examples of this Instance are, some of them, of considerable interest in the History of Science, but they would require too much elucidation to be conveniently stated in this place.

Sometimes a crucial instance or test is of such a character that, if the experiment is attended by some result, something is proved, but if it is attended by no result, nothing is proved. Thus, for example, if a marked sovereign is taken from my room, the fact proves dishonesty on the part of some one about me; but, if not taken, the fact proves nothing, for the dishonest person may not have been in the room or may have abstained on this occasion from fear of detection. It has been

[redacted]tests of this kind *unilateral*.

[redacted]ive Instances, some specially

adapted to the speculative, others to the operative branch of science, but those which I have already adduced will be sufficient to give the reader some idea of the value and interest of this part of the *Novum Organum*. Beyond this division the book does not proceed.

PART II.

I shall now briefly consider what are the principal merits of the magnificent fragment which I have just been describing, and also endeavour to estimate the value of the various objections which have been raised against Bacon's method of procedure as well as against his competence as a scientific reformer. Perhaps the main interest now attaching to the *Novum Organum* is the historical one of its subsequent influence on logic, philosophy, and science, a subject which I have discussed in a separate chapter.[4] As Macaulay finely says, Bacon "moved the intellects which have moved the world." But, inasmuch as I believe the intrinsic value of this work even to students of the present day, and especially to young students, to be very considerable, I shall briefly state the points wherein I conceive its merits principally to consist. These may be considered under two aspects. The first is its general effect in guarding, stimulating, and disciplining the intellect; the second is the amount of definite logical doctrine comprised in it which still retains any permanent value.

With regard to the first point,[5] I know no work of the same

[4] See ch. 6.

[5] Much of what I here say is repeated or adapted from the 15th Section of my Introduction to the *Novum Organum*. As I have stated in the Preface, I have frequently borrowed from my larger work, where I have thought that nothing would be gained by any new presentation of my remarks or opinions.

kind so stimulating to a young reader, or so likely to foster habits of cautious and independent investigation, as the First Book of the *Novum Organum*. What Bacon says of Plato is pre-eminently true of himself. He was "a man of a sublime genius, who took a view of everything as from a high rock."[6] Now to the young student nothing is of so much importance as to be brought into contact with works of real genius. To lay oneself alongside a really subtle and capacious mind is almost an education in itself, and there must have been many men who have looked back on their first acquaintance with the profound and brilliant pages of Bacon as forming one of the eras in their lives. Maxims such as these, "Man is the servant and interpreter of nature," "Human knowledge and human power meet in one," "It is not fruit-bringing but light-bringing experiments that should be sought," "Truth is rightly called the daughter of time, not of authority," "The worst thing of all is the apotheosis of error,"[7] which sparkle on almost every page of the *Novum Organum*, live long in the memory, and insensibly influence our whole habit of thought.

There is something about Bacon's diction, his quaintness of expression, and his power of illustration, which lays hold of the mind, and lodges itself in the memory, in a way which we hardly find paralleled in any other author, except it be Shakspeare. And what are the lessons which he thus effectually communicates? The duty of taking nothing upon trust which we can verify for ourselves, of rigidly examining our first principles, of being carefully on our guard against the various delusions arising from the peculiarities of human nature, from

[6] *De Augmentis Scientiarum*, book iii. ch. 4.

[7] "Homo naturæ minister et interpres," "Scientia et potentia humana in idem coincidunt," "Lucifera experimenta, non fructifera, quærenda," "Recte veritas temporis filia dicitur, non auctoritatis," "Pessima res est errorum apotheosis."

our various interests and pursuits, from the force of words, and from the disputes and traditions of the schools; the duty of forming our conclusions slowly and of constantly checking them by comparison with the facts of nature and life, of avoiding merely subtle and frivolous disputations, of confining our inquiries to questions of which the solution is within our power, and of subordinating all our investigations to the welfare of man and society. Now, lessons such as these, even though they be stated in a somewhat exaggerated form, are so necessary and so useful, that an author who presents them in forcible and pointed language will ever retain his interest and utility for each succeeding generation of learners. This educational value of the *Novum Organum* has never, I think, been sufficiently pointed out, but it seems to me very real and very important.

As regards the second point, the amount of definite logical teaching in the *Novum Organum* which retains a permanent value, much misconception prevails, and much injustice has been done to the author. Some of Bacon's critics, especially Baron Liebig, whose diatribe[8] affords an example of literary animosity which is fortunately rare in recent times, condemn

[8] *Ueber Francis Bacon von Verulam und die Methode der Naturforschung*, von Justus von Liebig. München, 1863. This pamphlet is written in a tone of such shrill invective, that it almost seems as if Bacon had been a personal enemy of the writer. In addition to its extreme bitterness, it is often very inaccurate, and does not, as it appears to me, in any way conduce to the knowledge or appreciation of Bacon's system. It was published in an English form in *Macmillan's Magazine* for July and August, 1863, and has been translated into French by M. de Tchihatchef, whose blunders show a singular incompetence for dealing with the History of Science and Philosophy. Some of Bacon's recent critics in England appear unfortunately to have borrowed their weapons of offence mainly from Liebig's pamphlet. I shall speak again of the adverse critics of Bacon's method and philosophy towards the close of this chapter.

almost all his logical precepts as antiquated or worthless. Their principal charges against Bacon as a reformer or pretending reformer of scientific method and their objections to his procedure, I shall examine presently. But I shall first point out what I conceive to be some of his positive merits. That the *Novum Organum* is not a complete treatise on Inductive Logic, and that many of its rules require explanation or revision, must of course be acknowledged. This is only to say that it was written two and a half centuries ago, and that it needs a commentary, either oral or printed. But the best introduction to a subject is often found to be through some historical monument which is less formal and technical than modern text-books, and which displays the efforts of genius in attempting to understand and overcome the fundamental problems and difficulties of the science. It is on these grounds that many persons regard the writings of Aristotle and Plato as forming the best introduction to the study of philosophy, and it is on the same grounds that I venture to suggest that the study of the inductive branch of scientific method might well begin with the *Novum Organum* of Bacon.

Amongst the positive merits of this work, regarded as containing a body of precepts for the conduct of scientific inquiry, I may specially draw attention to the following points:—

(1) The constant emphasis with which it dwells on the necessity of a thorough acquaintance with the facts of nature, as the only sure preservative against the delusions of fancy or prejudice and the misleading influence of authority. "Man is the servant and interpreter of nature." "We can only conquer nature, by first obeying her."[9] Hence the great importance which Bacon always attaches to the construction of what he calls a Natural History.[1] This was to be a collection

[9] Natura non nisi parendo vincitur, book i. aph. 3.

[1] See, for instance, *Nov. Org.* book i. aph. 98.

of facts of all kinds, whether bearing on man or on external nature, specially adapted to the wants of Natural Philosophy, and containing a record of experiments as well as observations.

(2) The importance of not contenting ourselves with mere observation, but of also instituting, where possible, artificial experiments for the purpose of obtaining more precise answers to our questions, is another point which Bacon brings forcibly before his readers. "For even as in civil matters a man's disposition and the secret workings of his mind and affections are better discovered when he is put in pain than at other times; so likewise the secrets of nature reveal themselves more readily under the vexations of art than when they go their own way."[2] The Second Book of the *Novum Organum*, as well as some of Bacon's minor works, affords several instances of ingeniously devised experiments, often, however, proposed rather than effected. I may adduce as an example the remarkable experiment, described in *Nov. Org.* book ii. aph. 45, the object of which was to determine the question of the compressibility or incompressibility of water by confining it in a leaden globe and then subjecting the globe to extreme pressure. This experiment has every appearance of having been original, and certainly preceded by nearly fifty years the celebrated experiment of a similar nature with a silver globe, usually called the Florentine experiment, made by the Accademia del Cimento at Florence. Both experiments were, as we now know, inconclusive, from the fact of the water exuding through the pores of the metals, but this circumstance does not detract from the ingenuity of conception which suggested them. The conclusion of the Florentine Academy was that

[2] *Nov. Org.* book i. aph. 98. For the differences between the two processes of observation and experiment, and the advantages which the latter possesses, in many respects, over the former, see Mill's *Logic*, book iii. ch. 7, or my *Inductive Logic*, ch. 2, § 1.

water is incompressible, that of Bacon that it is compressible. The truth of the latter inference has now been fully demonstrated by Canton, Oersted, and others.

(3) On this wide and varied basis of facts Bacon proposed to rear scientific inductions, as opposed to the mere enumerations of facts (Inductio per enumerationem simplicem) which were common in his time. The very conception of a scientific process of induction, proceeding by way of selection and elimination, is one which is even now by no means universal amongst men of information and culture, though it is most important that it should be thoroughly grasped by every student, whether of logic, philosophy, or science.

It is true that the Tables and the Method of Exclusions by which Bacon proposes mainly to work out his conception are cumbrous and, in the precise form in which they are stated by him, not always effective, but they easily admit of being corrected and re-stated so as greatly to elucidate the true and fruitful processes of Induction. But of more intrinsic value than this early part of the Second Book, as it seems to me, are some of the "Prærogativæ Instantiarum." Many of the expressions employed for the purpose of designating them still form part of our logical terminology, and it would be very difficult, in many cases, to describe, more aptly and precisely than Bacon does, the nature of the reasoning involved in them. The scientific examples are, generally, far too numerous, and (notwithstanding the value or interest attaching to some of them) are often wrongly stated, trivial, or inappropriate, but it appears to me that less attention than it deserves has been paid to the logical matter contained in this part of Bacon's work.

(4) Nor does Bacon neglect to point out the proper relation between the inductive and deductive processes of reasoning. From the often reiterated emphasis with which he insists on

the necessity of employing and reforming induction, the great need of his time, it has frequently been supposed that he slighted deduction as an instrument of thought, and regarded the inductive process as alone sufficient to supply us with all the truth we require. But this was by no means the case. The syllogism, he conceived, was indeed incompetent to establish the first principles from which it reasons, but, when these were once firmly established by induction on the basis of experience, it was perfectly competent to reason correctly from them. When the higher axioms have been constituted by induction, they should be developed deductively into all their consequences, and then ultimately, if they admit of it, applied to practice.[3] Even the mathematical form which the deductive branch assumes in the more advanced sciences is fully recognized by Bacon, and its proper position assigned to it. "Mathematics ought to terminate Natural Philosophy, not to generate it." "Natural inquiries have the best issue, when physics are terminated in mathematics."[4]

(5) Bacon distinctly sees that the real object of science is the ascertainment of causes or facts of causation. "It is rightly laid down that to know truly, is to know by means of causes."[5] Hence his insistance on the importance of a knowledge of the Form, by which, as we have seen, he understood practically what we understand by cause.

(6) He reads a valuable lesson also, when he insists on the unity of nature and the unity of science. Nature, he conceives,

[3] Sed axiomata, a particularibus rite et ordine abstracta, nova particularia rursus facile indicant et designant; itaque scientias reddunt activas. Book i. aph. 24. Cp. book ii. aph. 10.

[4] Mathematica philosophiam naturalem terminare, non generare aut procreare debet. Book i. aph. 96. Optime autem cedit inquisitio naturalis, quando physicum terminatur in mathematico. Book ii. aph. 8.

[5] Recte ponitur: vere scire, esse per causas scire. Book ii. aph. 2. Cp. Aristotle's *Posterior Analytics*, book i. ch. ii. ad init.

is a continuous and orderly whole, admitting of no breaks and no exceptions. Objects and qualities apparently the most heterogeneous are often united under the same Form, or, as we might say, are manifestations of the same law (Book ii. aph. 17); and he who best knows the ways of nature, also best knows her deviations (Book ii. aph. 29). Similarly, to know any one science really well, a man must know at least the general aspects and fundamental principles of all sciences. For the individual sciences are like the branches of a tree which meet in one trunk, and each science must suffer if rudely dissevered from the rest.[6] Of course, this maxim must not be pressed too far, or else our knowledge would be in danger of becoming merely vague and superficial, but much faulty reasoning and many confused ideas doubtless have their origin in the limited vision of the specialist. These defects it is the special object of logic and philosophy to remedy.

(7) I may remark, lastly, that Bacon's classification of Fallacies (Idola) is an original and valuable contribution to that department of Logic which deals with the types of incorrect rather than of correct reasoning.

I shall now proceed to consider some of the principal objections which have been directed against the method of scientific investigation delineated in the *Novum Organum* as well as against Bacon's competence to act in the capacity of a reformer of science and scientific method.

[6] See *Novum Organum*, book i. aphs. 79, 80; *De Augmentis Scientiarum*, book iii. ch. 1; *Advancement of Learning*, book ii. I have been obliged to describe these thoughts in somewhat general terms, as the functions ascribed to the Philosophia Prima in the *De Augmentis* and the *Advancement of Learning* seem to be ascribed to Natural Philosophy ("magna ista scientiarum mater") in the *Novum Organum*, and yet this word is also used in this same book in a more restricted sense. I have discussed these difficulties in my notes on book i. aphs. 79, 80.

Three of the objections may conveniently be considered together, inasmuch as an estimate of their value depends on a previous consideration of the true character of the inductive process. These are: (1) that Bacon's theory of induction is far too mechanical, attaching too much importance to rules and formulæ; (2) that he ignores or unduly neglects hypothesis; (3) that his conception of a gradual ascent from axioms of the lowest to axioms of the highest degree of generality does not correspond with the actual conduct of scientific investigation, nor would any advantage be derived from its being realized. It will be found that there is a considerable amount of force in these objections, especially in the two latter ones, but I can only state my own position in reference to them by previously describing and comparing the two different theories of induction as now commonly held. According to one of these, we begin by observing a number of facts or creating facts for ourselves by way of experiment, and then proceed to form certain theories or assumptions for the purpose of explaining their occurrence. These theories or assumptions are called *hypotheses*. If they satisfactorily explain the phenomena known to us, they may be accepted as provisionally true. But we should constantly be on the look-out for new facts, which may either confirm, destroy, or modify our hypotheses. If our original hypothesis, or a subsequent modification of it, continues to stand this test, and, still more, if calculations based upon it enable us to predict the future, and, most of all, if it enables us to explain not only facts of the same kind as those which suggested its formation, but also facts of a different kind from those which were then contemplated, we may feel certain, or almost certain, that it is a valid induction, correctly explaining the phenomena under investigation. This is the theory of Induction advocated by Dr. Whewell, and, more recently, by Professor Jevons—with this difference, however,

that Dr. Whewell regards the results as certain, Professor Jevons only as "almost certain." Both alike deny the possibility of applying more stringent methods. And, if more stringent methods are inapplicable, I cannot but think that Professor Jevons arrives at the true conclusion, when he maintains that all inductive inference is merely probable and can never attain to certainty. This conclusion is, however, directly opposed to the convictions, not only of mankind at large, but of the great mass of scientific inquirers, most of whom would doubtless be somewhat startled if they heard the laws of astronomy, mechanics, or chemistry described merely as "highly probable." The other theory of induction is that advocated by Mr. Mill, and, as I believe, implicitly assumed by nearly all competent reasoners in the various branches of inductive investigation. It is that by the employment of stringent methods of elimination we may give our inductions the force of demonstration, and that there are methods of this kind whose conditions it is, under certain circumstances, possible to satisfy. Mr. Mill propounds such methods in his well-known Canons of the Experimental Methods. This theory does not deny or ignore the importance of hypothesis as stimulating and directing inquiry, but it refuses to accept any hypothesis as a sufficient explanation or, in other words, as a valid induction, till it has satisfied some more stringent condition of verification than that of mere conformity with facts whether observed or predicted.[7] Now Bacon, I conceive, had hit upon a perfectly sound and very fertile idea, when he represented to himself the possibility of laying down rules by which inductive reasoning might possess the force of demonstration (*Novum*

[7] For a further statement of my opinions on these questions, see the Preface to the Third Edition of my *Inductive Logic*, and also pp. 113—119, 209—213 of the same edition of that work.

Organum, book i. aphs. 105, 122). Nor did he make by any means contemptible essays, especially in the Prærogativæ Instantiarum, towards furnishing such rules. But, when he maintains (as he does in Aph. 122) that his method will almost equalize the intellectual capacities of mankind, and enable ordinary men to arrive at correct inductions much in the same way that they now draw a circle with a pair of compasses, he is advancing not only a paradox, but a delusive, and possibly a mischievous, paradox. There is not, and there never can be, a mechanical method of invention, furnishing rules whereby men of average abilities may invent arts or make discoveries with the same facility and certainty with which they use a mathematical instrument. The reason of such impossibility, as I have said in one of my notes on this Aphorism, is to be sought not only in the complexity and "subtlety" of nature (which Bacon thought to be much simpler than it is) and in the laborious and complicated character of many of the processes of reasoning, but also in the important and, indeed, indispensable share which imagination has in all scientific discovery. It is then on account of these exaggerated statements, I take it, and not because he conceived the possibility of devising an inductive process guided by rules and resulting in certainty, that Bacon deserves the reproach of having formed too mechanical a theory of induction. The office of the imagination (a faculty in which he was himself so marvellously rich) is undoubtedly too much depreciated, or rather ignored, throughout the *Novum Organum*. And hence it is that he says so little of hypothesis. Except in Book i. aph. 106 and Book ii. aph. 20, this indispensable aid of the greater part of our inductive reasoning is hardly ever referred to. The wild licence of imagination exemplified in so many of the scientific writers of his time naturally caused an extreme recoil against

hasty generalisation and theories which seemed to be in advance of the facts. It was this same feeling, doubtless, which suggested to Bacon the oft-repeated maxim that induction should proceed from particulars to axioms of a very low degree of generalisation (axiomata infima), and thence slowly and gradually, through successive stages of intermediate axioms (axiomata media), up to the highest axioms of all (axiomata maxime generalia), and that we should never arrive at these last, or indeed at any axioms of any high degree of generality, by sudden leaps. But this method of gradual and continuous ascent is not the method which, for the most part, has been actually pursued by the most successful interrogators of Nature, nor would its general adoption contribute to the advancement of science. If the inquirer sees his way at once to a bold and sweeping theory, there can be no objection to his passing over the intermediate steps of the induction, providing that he afterwards submit his theory to the most rigorous examination, and resist the temptation of accepting it as a final explanation till it has been duly verified by stringent methods of proof. Though, however, this more ambitious process is a common and a perfectly legitimate method of *discovery*, the *proof* of the higher axioms, when established, will generally be found to rest on intermediate axioms, and of these on still lower axioms, and so on, after the manner which Bacon describes. Moreover, when a science has attained anything like completeness, this will always be found to be the most convenient method of exhibiting the relation of its various laws. In Whewell's *Novum Organum Renovatum*, a table of this kind is given, showing the successive inductions on which the theory of Universal Gravitation rests, and, in this case, it is curious to remark that the order of discovery followed almost exactly the present order of proof. Though stated too exclusively, therefore, this part of Bacon's doctrine is by no means so untrue to

facts or to the reason of the thing as it has sometimes been represented to be.[1]

Another objection frequently taken to Bacon's conception of scientific method is that it disparages or ignores the deductive side. That this objection is unfounded, I have already shown on pp. 136, 137.

The objection that Bacon in his statements on Forms and in his Tables overlooks the circumstance of Plurality of Causes has also been already mentioned. But there is one passage in the *Novum Organum* (book ii. aph. 23), where he seems explicitly to recognize Plurality of Causes, and, moreover, we must recollect that Form may in some places be more accurately replaced by the word Essence than by the word Cause, in which cases the objection does not hold. The difficulty, however, occasioned to the reader by the undefined and vacillating use of this word Form is itself, it must be confessed, a serious blot on the work.

Perhaps this is the most convenient place for considering one of the main peculiarities of Bacon's system, namely, his rejection of the inquiry into Final Causes in Physics, and the exceptions taken to it on this ground. The "Final Cause" is one of the "four causes" of Aristotle, and signifies "the wherefore" (*τὸ οὗ ἕνεκα*) or "the end" (*τὸ τέλος*) for which a thing exists. Aristotle assumed that every object has such an end ("Nature does nothing in vain"), and, apparently also, that we are competent to ascertain it. These assumptions were common amongst his successors, and were generally accepted in Bacon's time. No account of any natural object or operation was supposed to be complete unless it assigned its end or

[1] For further remarks on this subject, see my notes on *Nov. Org.* book i. aph. 19.

final cause. Now Bacon did not propose to banish this inquiry altogether, but to relegate it from Physic, which he supposed to be concerned solely with Material and Efficient Causes, to what he called Metaphysic, which was to inquire into Formal and Final Causes. The consequence of its consideration in Physics, he maintained, had been to expel from that branch of knowledge the inquiry into physical causes, and so to give men an excuse for resting in these "specious and shadowy" causes, instead of pressing on their inquiry into causes the existence and action of which they could verify. In Metaphysic such an inquiry might be proper, but in Physic it was impertinent (*De Augm.* iii. 4). For in physics we want to know how and from what conditions a thing is produced, not what object it subserves in the economy of nature. Moreover, the inquiry into Final Causes results in no works or inventions (an idea always uppermost in Bacon's mind), being like a virgin consecrated to the service of God (*De Augm.* iii. 5).

This metaphor, which I believe Bacon employs quite seriously and not with the slightest intention of banter, may perhaps best disclose to us his point of view. We may, he conceived, legitimately attempt to ascertain (and the attempt, though it may here and there fail in particular instances, will be crowned with more or less of success) the ends and objects of the various parts of nature, their relations to one another, and the harmony of the whole, and so rise to some conception, however faint, of the power, wisdom, and goodness of Him who framed the Universe. "That there is a God, that he holds the reins of things, that he is all-powerful, that he is wise and fore-knowing, that he is good . . . may be proved to demonstration even from his works" (*De Augm.* iii. 2). But then this inquiry must remain consecrated to the service of God. As soon as it intrudes into the province of Physics, it is attended with no results; nay, rather, as it diverts the mind from the

inquiry into efficient and material causes, the proper object of physics, it becomes positively baneful.

I conceive, therefore, that in the sphere of what we should call Natural Theology, Bacon would have approved and encouraged the inquiry into Final Causes, but that he proposed to banish it altogether from the domain of Physics. Such an exclusion was, I believe, far too rigid and absolute. It is certainly a curious commentary on his procedure that, at the very time when he was composing the *Novum Organum*, Harvey was employing this very mode of reasoning in the famous researches which resulted in the discovery of the circulation of the blood. Nor would any one, I presume, now deny that the idea of *function*, which implies so much of the idea of Final Cause as is included in the word *adaptation* as distinct from *design*, is a conception absolutely essential to the successful prosecution of at least one science, that of physiology. And, even in the higher sciences of psychology, ethics, and politics, there are few inquirers who can avoid from time to time asking the question, what purpose does such and such a constituent subserve in the mental, moral, or social economy. In chemistry, mineralogy, and those branches of science to which the word "physics" is often restricted, such inquiries are much rarer, but I question whether there is any single science, other than mathematical, from which the idea of adaptation can be strictly and consistently excluded. How we are to interpret the fact of adaptation is a different question, and one which, by the majority of scientific inquirers, would now be answered in a very different fashion from what ever occurred to any but a few isolated thinkers in previous generations. It is enough here simply to allude to the theory of Evolution, and to works such as those of Mr. Darwin, Mr. Wallace, and Mr. Herbert Spencer. To prevent, however, any misconception of my own opinions, I may, perhaps, repeat

what I have already said in another place, that the main drift of the arguments employed in Natural Theology is not affected by the modern theory of Evolution. If I may be allowed to quote myself, "I am far from denying that the Argument from Final Causes, if it take sufficient account of the evolution of organisms and their power of adapting themselves to external circumstances, and if it be based on the contemplation of Nature as a whole, instead of on that of individual objects, may not admit of being stated in such a form as to occupy once more an important position in any scheme of Natural Theology. Bearing in mind these qualifications, it may be perfectly legitimate to speak, with reference to the universe at large, of design and a designer, whatever may have been the agency, and however mysterious and prolonged the process, by which an intelligent Creator may have worked. Theories of evolution may be so stated as not to impair, but indefinitely to exalt, our ideas of the power, wisdom, and benevolence of the Being in whom Nature had its source."

In defence, however, of Bacon's undiscriminating rejection of the consideration of Final Causes in physical inquiries, it ought to be pleaded that the use of this topic in ancient and mediæval philosophy, as well as in the writings of his contemporaries, was often arbitrary, fanciful, and absurd to the last degree. "The handling of final causes," had certainly "intercepted the severe and diligent inquiry of *all real* and physical causes," and it might well be maintained that their temporary expulsion, could it have been effected, would have been a real service to science. As it was, I believe that the protest of Bacon and Descartes, who was as little tolerant as Bacon himself of this mode of explaining physical phenomena, exerted a decidedly wholesome influence on the scientific procedure of their successors.[9]

[9] I have discussed the question of Final Causes generally, and given

These, so far as I can recall them, are the main objections taken to Bacon's method or to his exposition of it. There are two other objections of a more miscellaneous kind which I must not pass over in silence. His method, it is sometimes said, was not original. And again it has been said that his own ignorance of the best contemporary science was so great, that he was thereby disqualified from assuming the office either of a reformer of science or of a reformer of scientific method.

As respects the originality of Bacon's method, the indiscreet praise of some of his admirers, who speak sometimes as if he had invented Induction and as if there had been no experimental philosophy before the appearance of his works, has naturally led to a reaction equally exaggerated. In my Introduction to the *Novum Organum* (§ 13), I have endeavoured at some length to distinguish the points in which his method and teaching had already been anticipated and those wherein he may fairly claim the merit of originality. Here I can only find space for a very brief summary of the results there arrived at. That Induction of some kind or other, and, consequently, the collection and examination of facts, is as old as human reasoning itself, I have already remarked at the beginning of this chapter. And, as I have also said there, the recognition of induction by philosophers as the proper method of establishing first principles dates back at least as far as the time of Aristotle, if not of Plato and Socrates. Moreover, not only did Aristotle often show in practice considerable skill in selecting his instances (though it must be confessed that he often showed equal carelessness), but there are isolated passages in his

several instances of those assigned, often absurdly enough, by old writers, in my *Inductive Logic*, 3rd ed. pp. 336—351. The reader who wishes to see Bacon's position in relation to this question examined at greater length may refer to § 10 of my Introduction to the *Novum Organum*.

writings from which it might be argued that he had even formed the conception of the possibility of framing methods of elimination. But these passages are so brief, and the remarks contained in them so incidental, that they hardly affect the general statement, so frequently made by writers on the history of philosophy or logic, that the sole form of induction recognized by Aristotle was that *per enumerationem simplicem*. Experiments he appears to have tried but rarely, though his physiological works show that he was aware of the importance of them. His psychological doctrine of the ultimate origin of knowledge in the perceptions of the senses and his logical doctrine of the ultimate dependence of the major premiss of a syllogism on previous inductions were admirably calculated to keep alive, even amongst the most dogmatic of his successors, some regard for the observation and collection of natural facts. Accordingly, it would be easy to multiply passages, even from mediæval writers, which appeal to experience as the ultimate test of truth in speculations on nature, which extol the office of induction, and which contain records of experiments as well as observations. Albert the Great and our own Roger Bacon (who has many points of resemblance with his later namesake) are specially to be remarked as precursors of a more liberal and scientific age. But so abstract and dogmatic was the ordinary course of speculation, and so intense was the reverence for authority, throughout the Middle Ages, that these maxims bore little fruit, and were well-nigh buried under the mass of theological, metaphysical, and commentatorial literature in which those times abounded. The Revival of Letters was marked by a strong reaction, amounting sometimes to a shrill invective, against the principle of authority, and this reaction generally took the form of an exaggerated, not infrequently an unintelligent, attack on the philosophy of Aristotle. The climax of this rebellion against the authority

of the great philosopher was reached by Ramus (one of the victims in the Massacre of St. Bartholomew in 1572) who is said, perhaps inaccurately, to have selected as the thesis for his Master of Arts' Degree at Paris the position that all the statements of Aristotle are false.[1] As opposed to authority, and especially the authority of Aristotle, many of the writers of this time exhort their readers to have recourse to their senses, to experience, to nature. Some even of those who were most ready to give play to their own imaginations combat with vehemence the fancies and arbitrary hypotheses of other philosophers, as resting on no basis of facts. And a few, who had specially devoted themselves to physical researches (of whom a conspicuous example is to be found in William Gilbert, the author of the treatise on the Magnet), not only warmly commend the recourse to artificial experiments in theory, but successfully adopt it in practice. But, so far as I can ascertain, no one had yet pronounced himself even on these topics with so much point and force, or in a manner so well calculated to lay hold of the popular sympathy, as Bacon, while, with respect to the fertile conception of a scientific and methodical process of induction, as opposed to that then in vogue, I have found nothing in any previous writer which can properly and fairly be said to be an anticipation of the suggestions so abundantly scattered throughout the *Novum Organum*.

With respect to the second objection, that Bacon was not fully abreast of the scientific knowledge of his own day, I fear an equally satisfactory answer can not be given.[2] Much is doubtless to be said in extenuation, but an impartial judge can only advise a plea of "Guilty" on many of the counts in

[1] On the Reaction against the Authority of Aristotle, see § 12 of my Introduction to the *Novum Organum*.

[2] For a more detailed examination of this question, see § 6 of my Introduction to the *Novum Organum*.

the indictment. He makes no mention of Harvey's great discovery of the Circulation of the Blood, though Harvey had already begun to teach it in 1619, the year before the appearance of the *Novum Organum*. It may here, however, be pleaded in extenuation that most of Harvey's contemporaries, even in his own profession, regarded his theory as hardly worthy of serious discussion. Aubrey, in his *Lives*, tells us that "after his booke of the Circulation of the Blood came out [in 1628], he fell mightily in his practice, and 'twas believed by the vulgar that he was crack-brained; and all the physitians were against his opinion, and envyed him." Again, Bacon appears never to have heard of the astronomical discoveries recently made by means of Kepler's calculations, and he was singularly ignorant of many facts both in the theory and the history of Mathematics and Mechanics. We must recollect, however, that the communication of discoveries was much slower in those days than at present, and that the publication of discoveries by means of memoirs or books was often delayed for many years. Thus, much has been said about Bacon's ignorance of Galileo's experiments on Falling Bodies, made at Pisa between 1589—1592. But, though these experiments were undoubtedly known to many scientific men, Galileo did not publish any account of them till the appearance of his *Dialogues* in 1632. As to his silence with regard to Kepler, it is curious that it is shared with Descartes, and, though Bacon was probably ignorant of Kepler's writings, Descartes cannot well have been. To return to the indictment, he was evidently a believer not only in Natural but in Judicial Astrology, though with a certain amount of hesitation and discrimination. He accepted, without question, the Peripatetic doctrine of the transmutability of the elements, and was a firm believer in the possibility of transmuting metals. This latter error, however, if such it be, which is often so much insisted on by the

more hostile critics of Bacon's philosophy, was maintained many years afterwards by Boyle, whose special business was with this class of questions, and treated without disrespect by Newton. Absurd moreover, as are some of the recipes for conducting the operation, the thing itself is not beyond the bounds of possibility. "There was a time," says Faraday,[3] "when this fundamental doctrine of the alchemists was opposed to known analogies. It is now no longer so opposed to them, only some stages beyond their present development." The *Sylva Sylvarum*, from which Bacon's critics draw largely and of which, as we have seen,[4] Bacon himself said that "he should better have served the glory of his own name, if he had not published it," contains a number of fancies so absurd that hardly any one who can read and write would now give any credence to them.[5] On Bacon's behalf, however, it may be pleaded that to believe in fancies of this kind was one of the common characteristics of his age, and that probably no man of that time was altogether free from them. But far the most important and, perhaps at first sight, the least excusable of Bacon's scientific errors was his persistent rejection of the Copernican theory. It seems indeed strange that one who laid claim to be the great reformer of science should have steadily refused to admit the greatest reform in scientific conceptions which had been proposed for many generations, and which had already been before the world for eighty years. And, undoubtedly, the discovery by Galileo of the satellites of Jupiter in 1609, as well as the calculations of Kepler announced about the same time (with which last, however, Bacon does not seem to have been acquainted), had considerably added to

[3] *Lectures on Non-Metallic Elements*, p. 106.

[4] See p. 35.

[5] Some specimens are given in my description of the *Sylva Sylvarum* on pp. 35, 36.

the evidence in favour of the heliocentric system, even while the *Novum Organum* was being written. Still, it cannot be said that, till the laws of formal astronomy were connected by Newton with the physical laws of matter and motion, the motions of the earth or its relation to the rest of the solar system could in any way be regarded as placed beyond the range of dispute. In Bacon's time, and especially during the earlier period of his life, men might well be excused who suspended their judgment, or who even preferred to adhere to the old assumption till their objections to the new theory were removed. And Bacon certainly did not stand alone in his opposition, among the eminent men of that age. Among those of his contemporaries who rejected the Copernican theory were Tycho Brahé (who, however, having died in 1601, did not live to become acquainted with the discoveries of Galileo), Vieta, the greatest mathematician of the 16th century (who, however, also died as early as 1603), Clavius, who was employed by Gregory XIII. to reform the Calendar and was called the Euclid of his age, and possibly, from his silence, the famous mechanician, Stevinus.[6] The history of Bacon's attitude towards this question appears, from a comparison of various passages in his works, to have been much as follows. In early life, like the majority, probably, of even his scientific contemporaries, he seems to have conceived a strong prejudice against the Copernican theory. In middle life, he wavered for a time, or, at least, felt some hesitation, though never, I believe, to the extent of adopting the theory of the earth's motion. The reasons against the theory, probably, appeared to him more and more decisive, till at last, with advancing

[6] Further information on this subject will be found in Delambre, *Histoire de l'Astronomie Moderne*, and in two most interesting papers contributed by the late Professor De Morgan to the *Companion to the British Almanac* for 1836 and 1855 respectively.

age, he became positive in his opposition to it. Now, surely, this is a piece of mental history so common, and one to which we are all in turn so liable, that, before casting our stone at Bacon, we may at least pause to consider the circumstances of his age, the attitude with respect to the same question assumed by his contemporaries, and the amount of evidence by which the doctrine he rejected was at that time supported. To parallel cases there is no limit, but I may specially mention the tenacity with which the Cambridge mathematicians adhered to the Cartesian system long after the publication of Newton's discoveries (which, unlike those of Copernicus, possessed demonstrative force), the slow rate at which those discoveries were received on the continent of Europe, and the obstinate resistance offered by Leibnitz to the Newtonian doctrine of Gravitation. Not only are we liable to ascribe to a theory now fully established a degree of perfection and an amount of evidence which it did not at first possess, and then express our surprise that it was not at once universally welcomed, but we are also given to assume that the almost superstitious reverence with which we now invest the great names of the past ought to have exercised an equal influence over their contemporaries.

Notwithstanding these grave examples of deficiency of judgment or information, it must be urged, on the other side, that the wealth of illustration exhibited in the *Novum Organum* and the vast range of subjects reviewed in the *De Augmentis* show a width of knowledge and an universality of interest which were probably unequalled in the case of any other man then living. What Bacon gained in width, he, of course, to a certain extent, lost in depth; for this is the universal law of the human intellect. He was not, and did not pretend to be, a Specialist. His business was, so to speak, with the philosophy and logic of science, rather than with the body of science

itself; what he hoped to do, was not so much to advance science in his own person, as to impel others to the work, and to point out to them the goal at which they were to aim and the means by which they were to attain it. That he was, to a large extent, successful in this mission, I hope to show in a subsequent chapter.[7] At the same time, though it is only when we consider science in its totality that we can assign Bacon his due place in its history, it would be an injustice to him not to notice that, even in the particular sciences, he threw out many suggestions of rare sagacity, and, in a certain sense, anticipated more recent discoveries. Such were his speculations on Colour, his anticipation of the recent theory of Heat, his experiment on the compressibility of water, and his wonderful appreciation of the combined unity and variety in Nature, already referred to in this chapter. To these instances may be added his sagacious and possibly fertile suggestion of a closer union between formal and physical astronomy, as well as of the necessity of combining the explanations of celestial and terrestrial phenomena; the remarkable passage on Attraction, and the ingenious experiment proposed in connexion with it, in *Nov. Org.* ii. 36 (3); the brilliant conjecture, in *Nov. Org.* ii. 46, that the actual state of the starry sky precedes by an interval of time that which is apparent to us, or, in other words, that light requires time for its transmission; the implied criticism of the ordinary doctrine of species contained in a passage on Realism in *Nov. Org.* i. 66; and lastly (though this list is by no means exhaustive) the attempt made in the *Historia Ventorum* to consider the direction of the winds in connexion with temperature and aqueous phenomena, on which Humboldt highly compliments him as having thereby laid the foundations of a theory of the currents of the atmosphere. When we add to these claims on the recognition of scientific

[7] See ch. 6.

men, in the narrower sense of that term, the fact that in another department of knowledge, that of mind and conduct, Bacon's contributions, as I hope to show in the next chapter, were neither few nor unimportant, the contention that he was unfitted to set up as a reformer of scientific method, because he knew next to nothing of science and was incapable of making any discoveries of his own, may surely be disallowed.

It has been the fate of Bacon, while his merits have often been unduly exaggerated, to be attacked by his critics with singular and persistent bitterness. Passing over the earlier onslaughts on his system,[8] some of which were of an exceedingly scurrilous description, I may mention some of the principal attempts made to damage his reputation as a logician,

[8] See § 16, entitled the "Opponents of Bacon," in my Introduction to the *Novum Organum*. The only unfavourable opinion of Bacon's philosophy, expressed by a man of real eminence, previously to the present century which I have met with is that of Harvey, as given in Aubrey's *Lives* (*Letters written by Eminent Persons in the Seventeenth and Eighteenth Centuries*, to which are added *Lives of Eminent Men* by John Aubrey Esq., 1813, vol. ii. p. 381): "He" (Harvey) "had been physician to the Lord Ch. Bacon, whom he esteemed much for his witt and style, but would not allow him to be a great philosopher. Said he to me, 'He writes philosophy like a L^d^ Chancellor,' speaking in derision." Harvey, however, seems to have had a peculiar dislike of the "neoteriques," to whom, we are told on page 383, he once, in conversation with the writer, applied a very unsavoury epithet. Nor, perhaps, did he like Bacon personally; for (p. 226) "Dr. Harvey told me his eie was like the eie of a viper." Be this as it may, the opinion was not an unnatural nor altogether an unfair one, as expressed by a man of great eminence, in a particular branch of science, of one who attempted to make all science his province. Then as now, I presume, the philosopher and the specialist were apt to misunderstand and undervalue each other.

Hume, however (*History of England*, Appendix to the Reign of James I.), expresses only modified praise, and is the first author, I believe, to institute a comparison of Bacon with Galileo to the advantage of the latter.

philosopher, and man of science, during the present century. First in time and pre-eminent in bitterness comes the well-known work of Count Joseph De Maistre, entitled *Examen de la Philosophie de Bacon*, published posthumously at Paris and Lyons in 1836. The motive of this attack, which was undoubtedly provoked by the lavish praises bestowed on Bacon by Voltaire and the Encyclopedists, seems to be exclusively theological. But when, by modes of reasoning appropriate to an ultramontane fanatic, De Maistre has proved to his own satisfaction that Bacon was an atheist, who aggravated his atheism by hypocrisy, he proceeds to show that he was a charlatan and an impostor. He contributed nothing to science himself, and it is a mere delusion to suppose that his philosophy has in any way helped to form those who have done so. It is true that he preaches science, but then, like his Church, when it preaches Christianity, he preaches without a mission. As to individual works, the *De Augmentis* is absolutely contemptible; the *Novum Organum* is far worse still, for, independently of the particular errors with which it swarms, its general aim renders it worthy of Bedlam. Of the attacks made on Bacon since the appearance of De Maistre's work, the principal are those of Sir David Brewster, Lasson, and Liebig. The first of these authors, in his *Life of Newton* (1855), irritated apparently by the injudicious statement of "some modern writers of celebrity" that Newton "owed all his discoveries to the application of the principles of Bacon," maintains a proposition equally extreme, and, as it seems to me, equally untrue, that "he did not derive the slightest advantage from Bacon's precepts." Taking occasion of this incidental mention of Bacon, Brewster goes on to combat his claims generally as a reformer of science. Lasson's monograph (published by Gustav Lange, Berlin, 1860), though it extends only over thirty-two pages, is the weightiest of the attacks

upon Bacon which I have seen. It is written not only with more moderation, but with far more knowledge of Bacon's writings, and with more sympathy with the philosophical spirit in its relation to science, than is the violent diatribe of Liebig, so much better known in this country. While maintaining, with much truth, that the reformation of science was not the work of a single man, but the gradual product of the age, and disputing Bacon's claim to be regarded, in the proper sense of the term, as a philosopher, besides finding special fault with his theory of Induction, his conception of Forms, his criticism of Final Causes, &c., he allows that he did great service in spreading a taste for experimental inquiry and in drawing the popular attention to the importance of consulting facts. Liebig's pamphlet, which has been already noticed,[9] was occasioned by his annoyance at the rejection of some of his chemical theories by English agriculturists. Their singular obstinacy must, he thought, be due to some inherent defect in the English mind, and this suspicion led him to the study of the English philosophers. When, at last, he came to the works of Bacon, all was clear. These furnished, if not the source, at least the typical example of the methods of experiment and reasoning common amongst the English dilettanti who had had the temerity to reject his theories. This work repeats many of the arguments of Brewster and Lasson, but with much exaggeration and asperity. It seems to me to contribute absolutely nothing new to the controversy, and to display throughout a determination to make good at all hazards a preconceived opinion; and yet this appears to be the principal source from which many Englishmen now derive their estimate of the scientific and philosophical significance of their illustrious countryman.

[9] See note on p. 133.

As I shall hereafter have occasion to speak of the favourable, and even enthusiastic, appreciation of Bacon's method shown by various writers from his own day down to ours, I have thought it well here to say something, in connexion with the objections taken to it, of the most powerful, or the most influential, of its adverse critics.

CHAPTER V.

BACON'S PHILOSOPHICAL AND RELIGIOUS OPINIONS.

I PROPOSE, in the former part of this chapter, to consider Bacon's philosophical opinions, as distinct from his opinions on Logic and the Method of Science. I shall then pass on to his religious opinions, which may conveniently be considered in the same chapter.

Bacon was not the founder of a philosophical school. Indeed, there is no character which he would himself have more emphatically repudiated. "First of all, then, I must request men not to suppose that after the fashion of the ancient Greeks, and of certain moderns, as Telesius, Patricius, Severinus, I wish to found a new sect in philosophy" (*Nov. Org.* book i. aph. 116). But, though not the founder of any special school of philosophy, it seems to me unquestionable that his exposition of his method, and, perhaps, also individual expressions in his writings, contributed in no small degree to the creation of what is commonly called the empirical school of English philosophy. As, however, I shall discuss this question in the next chapter, it is unnecessary that I should dwell upon it here. It may be enough to say that, like Socrates, he rather gave an impulse to others, and suggested new lines of inquiry, than elaborated a definite system of his own.

But, at the same time, it is interesting to ask what the opinions of Bacon were, so far as we can gather them, on the

controverted questions of psychology, ontology, and ethics. Now, as to what, for want of a better name, may be called ontological or metaphysical questions, the questions, namely, which relate to the origin and essential nature of matter and mind, and the relation between the two, his ordinary attitude is that of a disinterested, if not a contemptuous, silence. The passage just cited proceeds as follows: "For this is not what I am about; nor do I think that it makes much difference to the fortunes of men what abstract notions one may entertain concerning nature and the principles of things; and no doubt many old theories of this kind can be revived and many new ones introduced, just as many schemes of the heavens may be supposed, which agree well enough with the phenomena and yet differ from each other." A deep sense of the unprofitable character of these speculations has, indeed, been a characteristic not of the Baconian philosophy only, but of British philosophy in general, which, with a healthy instinct, has usually either avoided them altogether or discussed them solely with the view of showing that they lie outside the limits of human knowledge. An apparent exception is, perhaps, to be found in Bacon's constant recurrence to the doctrines of the Atomists, as to the atoms and the void. But these, properly speaking, are questions of physics rather than of metaphysics. On the standing feud between what are, somewhat uncouthly, called the Idealists, the Materialists, and the Dualists, there is, so far as I am aware, no formal discussion in Bacon's writings, unless we count a passage in the De Principiis atque Originibus, in which, quite sincerely as I believe, he adopts the scriptural doctrine of creation out of nothing by the omnipotent power of God. "For there seem to be three dogmas which we know, as a matter of faith, concerning this question. The first is that matter was created out of nothing. The second, that the evolution of the system ("eductio systematis")

was effected by the word of omnipotence, and that matter did not evolve itself from chaos into that configuration. The third, that this configuration (before the fall) was the best of which matter (as it had been created) was susceptible. . . . . In these questions therefore we must rest upon faith and the firmaments of faith." [1]

The fact is that Bacon lived too early or too late to take any serious part in these metaphysical discussions. In their scholastic form they had become discredited, and their new form, under which they were to exercise so much of the best thought of the two succeeding centuries, had not yet been impressed on them by the genius of Descartes. Bacon assumes the ordinary distinction of mind and matter, an universe of objects to be known, and a thinking subject capable, with due care and discipline, of attaining to a knowledge of them, without, apparently, troubling himself as to the ulterior questions, what is knowledge, how can I become conscious of that which is not myself, and what are the ultimate meaning and relation of the two terms in this comparison.

On questions of psychology, as distinct from metaphysics, we find a fair number of passages in Bacon's writings. The most important perhaps are those in which, following Telesius, the celebrated philosopher of Cosenza (b. 1509, d. 1588), whose works seem greatly to have interested him, he asserts the duality of the human soul. Man, according to this doctrine (which is stated most fully in *De Augmentis*, iv. 3), has two souls, one peculiar to himself, the rational soul which he derives from the breath of God, the other, shared by him in common with the brutes, the irrational soul, which comes from "the wombs of the elements." "Let us now pro-

[1] The original of this passage will be found in Ellis and Spedding's *Bacon*, vol. iii. p. 110, or in my edition of the *Novum Organum*. p. 15.

ceed to the doctrine which concerns the Human Soul, from the treasures whereof all other doctrines are derived. The parts thereof are two: the one treats of the rational soul, which is divine; the other of the irrational soul, which is common with the brutes. I mentioned a little above (in speaking of Forms) these two different emanations of souls, which show themselves in their first creation; the one springing from the breath of God, the other from the wombs of the elements. For touching the first generation of the rational soul, the Scripture says, 'He made man of the dust of the earth, and breathed into his nostrils the breath of life.' But the generation of the irrational soul, or of brutes, was effected by the words, 'Let the water bring forth; let the earth bring forth.' Now this soul (as it exists in man) is only the instrument of the rational soul, and has its origin, like that of the brutes, in the dust of the earth. For it is not said that 'He made the body of man of the dust of the earth,' but that 'He made man;' that is, the entire man, excepting only the breath of life. Wherefore the first part of the general doctrine concerning the human soul I will term the doctrine concerning the Breath of Life; the second the doctrine concerning the Sensible or Produced Soul. And yet, as hitherto I handle philosophy only, I would not borrow this division from theology, if it were not consonant with the principles of philosophy also. For there are many and great excellencies of the human soul above the souls of brutes, manifest even to those who philosophise according to sense. Now, wherever the mark of so many and so great excellencies is found, there also a specific difference ought to be constituted; and therefore I am not too well pleased with the confused and promiscuous manner in which philosophers handle the functions of the soul, as if the human soul differed from the soul of brutes in degree rather than in kind, simply as the

sun differs from the other stars or gold from the other metals." It is possible that this theory of the material generation of the lower soul may have contributed to prepare the way for the reception of the purely materialistic account of the nature and origin of knowledge which was presented by Hobbes in the next generation. Such a result, however, I believe, would have been utterly abhorrent to Bacon himself.[2]

He next proceeds to distinguish between the Substance and the Faculties of each soul. The inquiry into the "substance" of the rational soul is a matter rather for theology than philosophy. "For inasmuch as the substance of this soul in its creation was not extracted or produced out of the mass of heaven and earth, but was immediately breathed into man by God, and inasmuch as the laws of heaven and earth are the proper subjects of philosophy; how can we expect to obtain from philosophy a knowledge of the substance of the rational soul? It must be drawn from the same divine inspiration, from which that substance first proceeded." But the doctrine concerning the sensible or produced soul is a fit subject of inquiry in philosophy, even as regards its substance. "For the Sensible Soul, or Soul of Brutes, must clearly be regarded as a corporeal substance, attenuated and made invisible by heat." It is, in fact, compounded of flame and air ("ex natura flammea et aerea conflata"). This soul, which in man is merely the instrument of the rational soul, just as in brutes it finds its own instrument in the body, might more fittingly be assigned a distinct name and termed "Spirit."

Quitting these theories, which to us appear so strange, but

[2] The materialistic tendency of Bacon's philosophy is, I think, exaggerated by Lange in his *History of Materialism.* See *Geschichte des Materialismus,* 2nd ed. vol. i. pp. 194—199 (English Translation, pp. 236—243). Lange, who seems too ready to adopt Liebig's conclusions, does scant justice to Bacon's merits.

which deal with topics much more familiar to the men of Bacon's generation than of ours, I may next note his enumeration of the Faculties both of the higher and the lower soul. The Faculties, he says, of the higher soul are well-known; they are Understanding or Intelligence (Intellectus), Reason, Imagination, Memory, Appetite, Will, in fine all those which are the object of the logical and ethical sciences. He then makes the profound remark that the origins of these faculties should be handled, and that physiologically or psychologically[3] (idque physice), a work towards which, as he says, nothing of note has yet been done. The faculties of Memory, Imagination, and Reason are made the basis of the general divisions of Learning into History, Poetry, and Philosophy. "Intellectus" or Understanding does not seem to be employed by Bacon in a special sense (like the Aristotelian νοῦς), as a faculty which supplies first principles for reasoning, but in a generic sense, as including Memory, Imagination, and Reason. Thus, in the Second Book of the *Advancement of Learning*, he says: "The parts of human learning have reference to the three parts of Man's Understanding, which is the seat of learning: History to his Memory, Poesy to his Imagination, and Philosophy to his Reason." And, though, in the corresponding part of the *De Augmentis* (book ii. ch. 1), the word "Understanding" is replaced by "Anima Rationalis," he seems almost immediately afterwards to employ Understanding ("Intellectus") as a generic term; for sense is called the door of the understanding ("intellectus janua"), and then the intellectual processes which follow on the impressions of sense are enumerated as Memory, Imagination, and Reason. Imagination exercises

[3] In Bacon's time, the word "physical" included both what we should now term psychological and what we should now term physiological. The Greek term for Nature (φύσις) was general in its meaning, and applied to the world of mind as well as the world of matter.

the functions of a messenger or intermediary in both departments, that of Reason and that of Will. "For sense sends all kinds of images over to imagination for reason to judge of; and reason again, when it has made its judgment and selection, sends them over to imagination before the decree be put in execution."[4] "But neither is the imagination simply and only a messenger; it is either invested with or usurps no small authority in itself, besides the simple conveyance of the message. For we see that in matters of faith and religion our imagination exalts itself above our reason. . . . . And again it is no small dominion which imagination holds in persuasions that are wrought by eloquence; for when by arts of speech the minds of men are soothed, inflamed, and carried hither and thither, it is all done by stimulating the imagination till it becomes ungovernable, and not only sets reason at nought, but offers violence to it, partly by blinding, partly by incensing it." The prominence here given to the warping effect of the imagination over the reason accords well with Bacon's neglect or depreciation of this faculty in his *Novum Organum*.

The inferior or sensible soul has two, or rather three, principal faculties, Voluntary Motion and Sense, from which latter we must distinguish Perception. Were it not for a marvellous mistake of M. de Rémusat,[5] it would hardly be necessary to point out that Bacon's distinction of Sense and Perception is utterly different from that drawn by later philosophers (such as Reid and Stewart) between Perception and Sensation. By Perception he understands unconscious or reflex action or reaction, whether in animate or inanimate bodies. Such are the attraction of the magnet, the union of two bubbles, recovery after pressure, in the case of insensible bodies; and, in the

[4] *De Augm.* book v. ch. i.

[5] *Bacon*, par Charles de Rémusat, p. 270, n. 1.

case of sensible bodies, the digestion of food, the beating of the heart and pulse, "the performance by the viscera, like so many workshops, each of its own work." Sense, on the other hand, is conscious affection. That this distinction is of great importance in Psychology need not be stated.

It may be noticed that the constant use of the term "Faculty," and the sharp line of demarcation drawn here and in similar passages between the offices of the so-called "faculties," was a common feature of the philosophy of the seventeenth and eighteenth centuries. Locke criticises the expression. "I suspect that this way of speaking of Faculties has misled many into a confused notion of so many distinct agents in us, which had their several provinces and authorities, and did command, obey, and perform several actions, as so many distinct beings; which has been no small occasion of wrangling, obscurity, and uncertainty in questions relating to them."[6] He proposes to substitute the word Power. A better substitute, perhaps, would be Act or Operation. Another danger attending the constant and incautious employment of this term may be pointed out in connexion with the more refined analyses of recent psychologists. Our mental operations are far more complex than at first sight would be supposed. Many of our psychical acts which are apparently the most simple admit, on analysis, of being decomposed into a variety of elements. Thus, I recognize an object in the street as a dog. This act, apparently so simple and instantaneous, involves at *least* Sensation, Perception, Association of Ideas, Recollection, Comparison, Judgment. Now, if I single out one of these elements, and call the act, say one of perception, or of recollection, or of judgment, I ought at the same time to bear in mind that it includes many other elements as well.

[6] *Essay concerning Human Understanding*, book ii. ch. 21, § 6.

As distinct from the "Doctrina de Anima" (or, as we should now say, Psychology), there are two arts which treat of the use and objects of the mental faculties. These are Logic and Ethic. "Logic discourses of the Understanding and Reason; Ethic of the Will, Appetite, and Affections: the one produces judgments, the other actions." (*De Augmentis*, book v. ch. 1.) Logic is used in an extremely wide sense, as including not only the Art of Discovery and the Art of Proof, but also the Art of Memory and the Art of Rhetoric.

That the only source of our ordinary knowledge is to be found in experience Bacon seems to assume throughout his works,[7] though he never, so far as I recollect, attempts to ascertain the conditions of experience or to analyse it into the elements of which it consists. The source of some portions of our knowledge, such as that of "the substance of the rational soul"[8] and of moral principles,[9] is referred to Divine Inspiration, but this, I think, is usually the inspiration of the Bible, given once for all, rather than any constant illumination specially imparted to the individual. In one place, however, at least, (*De Augm.* book ix.; E. and S. vol. i. p. 831,) he does undoubtedly refer our moral sentiments to a sort of divine influence, acting immediately and without any dependence on the ordinary avenues of knowledge. "It must be confessed that a great part of the moral law" [as communicated in the Scriptures] "is higher than the light

7. See, for instance, *Nov. Org.* i. 19—22; *De Augm.* iii. 1 ad init.: "For all knowledge admits of two kinds of information. One of them is inspired by divine revelation; the other has its origin in sense. Let us, therefore, divide knowledge into Theology and Philosophy." In the *Distributio Operis*, prefixed to the *Novum Organum*, he speaks of sense, as "that from which, in natural matters, all things are to be derived, unless a man please to go mad."

8 *De Augm.* iv. 3 (E. and S., vol. i. p. 606).

9 *De Augm.* vii. 3 (vol. i. p. 732); ix. (pp. 830, 831).

of nature can aspire to. Nevertheless what is said, that man has by the light and law of nature some notions of virtue and vice, justice and injustice, good and evil, is most true. But we must observe that the expression Light of Nature is used in two several senses: the one, so far as it springs from sense, induction, reason, arguments, according to the laws of heaven and earth; the other, so far as it flashes on the mind of man by an inward instinct, according to the law of conscience, which is a spark and relic, as it were, of his ancient and primitive purity. And in this latter sense chiefly does the soul partake of some light to behold and discern the perfection of the moral law; which light, however, is not altogether clear, but such as rather to convince us, in some measure, of vice, than to inform us fully of our duty." Here, in addition to the "Sense" and "Divine Inspiration" (there confined to Theology) which are spoken of as if they were the sole sources of knowledge at the beginning of the Third Book *De Augmentis*, we seem to have a third source of knowledge, corresponding almost exactly with what Butler and most popular moralists, in conformity with ordinary language, call "Conscience." This faint glimmering, as it were, of a primitive light may be one of the "many and great excellencies of the human soul," referred to in the passage quoted on p. 162.

Besides the points already noticed, I ought, in this connexion, to recall attention to the invaluable Aphorisms in the first book of the *Novum Organum* on the Idola Tribus and the Idola Specus, and to the fertile suggestion in *Nov. Org.* book i. aph. 127, on the possibility of treating Logic, Ethics, and Politics, that is to say, the moral and mental sciences generally, by the inductive method. One more matter of psychological interest may be added to this list, the striking contribution towards a theory of Memory and Association which occurs in *Nov. Org.* ii. 26 and *De Augm.* v. 5.

Bacon's Moral Philosophy, which is mainly contained in the seventh book of the *De Augmentis*, has, perhaps, hardly received the attention which it deserves. As Logic treats of the Intellect, Ethics treat of the Will. "The will is governed by right reason, seduced by apparent good; having for its spurs the passions, for its ministers the organs and voluntary motions." In a chapter of the preceding book (ch. 3), the ends of logic and ethics are well compared: "The end of logic is to teach forms of argument, in order to guard the understanding, not to ensnare it; in like manner, the end of ethics is so to compose the passions, that they may fight on the side of reason, and not invade it." The idea that morality consists in the co-ordination of the passions, in their rationalization, as we might say, is clearly and forcibly stated in this passage, though, of course, it is to be found in authors long anterior to Bacon.

Ethics may be divided into two principal doctrines, one, theoretical, treating of the exemplar or image of good, the other (to which he gives the fanciful title of the Georgics of the Mind), practical, laying down rules for the regulation and culture of the various parts of our nature, so as to bring them into conformity with the image of good, when found. Of this practical side of ethics, he complains that, for the most part, it has been passed over, as not enabling men to display the point of their wit or the power of their eloquence. On the theoretical side, he finds fault with previous philosophers for not having carried their inquiries deeper, by searching for the roots of good and evil, and the very fibres of those roots; "if they had consulted with the Nature of Things no less than with moral axioms" (that is to say, the popular and received notions of virtue and vice, pleasure and pain), "they would have made their doctrines less prolix, but more profound." He then endeavours to "open and cleanse the fountains of

morality" by examining its fundamental conception of Good. Good, he finds, is either public or private, and the appetite to both these kinds of good is native to the human mind, and, indeed, to everything which exists. "There is formed and imprinted in everything an appetite towards two natures of good: to one nature, inasmuch as everything is a Whole in itself; to the other, inasmuch as it is a part of a greater whole. And this latter nature is more worthy and powerful than the former, as it tends to the conservation of a more general form. Let the former be named "Individual or Self Good," the latter "Good of Communion." Those of my readers who are at all acquainted with the subsequent developement of Moral Philosophy in England will not fail to find in this sentence the germ of one of the leading ideas in the systems of Shaftesbury, Hutcheson, and many other English moralists.

Individual or Self Good is divided into Active and Passive Good, "which are best disclosed in the two several appetites in creatures: the one, to preserve and continue themselves; the other, to multiply and propagate themselves." Passive Good, again, is subdivided into Conservative and Perfective Good, whereof that of perfecting is the higher; "for to preserve a thing in its existing state is the less, to raise the same to a higher nature is the greater." Throughout the universe, there are always to be found "some nobler natures to the dignity and excellence whereof inferior natures aspire as to their sources and origins." But, when men, by the workings of blind ambition, are led to seek mere exaltation of place instead of an exaltation of nature, so false and preposterous an imitation of the desire for perfective good becomes the very plague of life, and a whirlwind carrying away and subverting all that is best within them.

"That good of man which respecteth and beholdeth society,"

I am here quoting from the *Advancement of Learning*,[1] "we may term duty; because the term of duty is more proper to a mind well framed and disposed towards others, as the term of virtue is applied to a mind well formed and composed in itself: though neither can a man understand virtue without some relation to society, nor duty without an inward disposition. This part may seem at first to pertain to science civil and politic" (which Bacon distinguishes from Ethics); "but not if it be well observed. For it concerneth the regiment and government of every man over himself, and not over others." "This part of duty is subdivided into two parts: the common duty of every man, as a man or member of a state; the other, the respective or special duty of every man, in his profession, vocation, and place." Casuistry is admitted into Ethics, as considering and deciding between "comparative duties." "The knowledge concerning good as respects society doth handle it also, not simply alone, but comparatively; whereunto belongeth the weighing of duties between person and person, case and case, particular and public.

It is a remark very characteristic of Bacon's practical turn of mind, as well as of his ethical point of view, that the superiority of the public to the private good determines the controversy amongst the ancient philosophers as to the relative advantages of the practical and contemplative life in favour of the former. For the reasons, he says, adduced by Aristotle in favour of the latter have respect only to private good and the pleasure or dignity of the individual. Nor, if the monastic life had been regarded as merely and strictly contemplative, and not engaged in the performance of any duties whatsoever, could any doubt on this question have ever arisen in the church. "As for mere contemplation, ending in itself, and casting no rays of heat or light on human society, assuredly Theology knows it not."

[1] The parallel passage is in *De Augmentis*, vii. 2.

It may be noticed also that Bacon finds a special argument for the divine origin of the Christian religion in its marked preference of the common to the individual good. "Never in any age has there been found any philosophy, sect, religion, law, or discipline, which did so highly exalt the good which is communicative, and depress the good which is private and particular, as the Holy Christian Faith; whence it is clear that it was one and the same God who gave those laws of Nature" (by which the lesser seeks the greater) "to inanimate creatures and the law of Christ to man."

It might be inferred from this passage, in which Bacon argues in favour of the divine origin of Christianity because it satisfies certain moral pre-conceptions, instead of supporting his ethical theory by the authority of Christianity, that he had already arrived at the point of view which regards Ethics as an independent science, having its roots not in Theology, but in human nature. The same conclusion might also be drawn from his general mode of treating ethical questions in the *De Augmentis*, as well as from the passage in the *Novum Organum* (i. 127) in which he includes Ethics amongst the sciences admitting of the application of the inductive method. Yet, when he comes to consider expressly the relation of Ethics to Theology, he regards the former as simply the handmaid of the latter, having indeed an office of her own, but one to be exercised in strict subordination to that of the master-science.[2]

[2] There is a curious passage in the *Advancement of Learning*, book i. (repeated in the *De Augmentis*, E. and S. vol. i., p. 465), in which the independent study of Moral Philosophy seems, by implication, to be unequivocally condemned: "As for the knowledge which induced the fall, it was not the natural knowledge of creatures, but the moral knowledge of good and evil; wherein the supposition was, that God's commandments or prohibitions were not the originals of good and evil, but that they had other beginnings, which man aspired to know; to the end to make a total defection from God and to depend wholly upon himself."

"*If it* be objected that the cure of souls is the office of Sacred Theology, the assertion is most true; but what is to prevent Moral Philosophy being received into the service of Theology as a prudent handmaid and faithful follower, to be ready, at her nod, to minister to all her requirements? For as it is said in the Psalm, that 'The eyes of the handmaid look perpetually to the hands of her mistress,' and yet no doubt many things are left to the care and discretion of the handmaid; so ought Moral Philosophy in all things to conform to Theology, and hearken to its precepts, yet so as it may yield of itself, within its own limits, many sound and useful lessons." The apologetic character of this passage, however, combined with the other considerations just urged, might justify us in arguing that Bacon was just on the point of detaching Ethics from Theology, but that the traditional teaching of his time was too strong for him. Hobbes, who devoted far more special attention to the ultimate grounds of moral and political ideas than Bacon had done, was, I believe, the first English writer who treated Morals as an entirely distinct science. Before the appearance of Hobbes' works, Grotius had already in his *De Jure Belli et Pacis* (published in 1625) adopted the same mode of treatment, and from Hobbes downwards it became almost a recognized principle amongst professed writers on Morals in England, however much their systems differed in other respects, to found them exclusively on the "Laws of Nature," the "dictates of reason," or the constitution of man. The Will of God ceased to be made the ultimate ground of moral obligation (except in a few instances, amongst which that of Locke is conspicuous), and the words of Revelation, if quoted at all, were quoted rather by way of illustration than of argument. Nor was this the case with lay writers only. The systems of Cudworth, Clarke, Hutcheson, and Butler are as "independent" as are those of Hobbes, Shaftesbury, and Hume.

To the fundamental questions of Morals, What makes an action right, How do I know that it is right, and Why should I do a right action rather than a wrong one, Bacon supplies no direct answers. Nor did he probably put these questions to himself in this direct manner. But if I may venture, from the fragments of a system which he has left us, to construct answers such as I think he would have given, had the questions been put to him, I would suggest that he might have expressed his views much as follows. An action is right which is good,—good, that is to say, either for ourselves or for others, and, wherever the good of self or of a smaller aggregate conflicts with that of a larger one, that action will, generally speaking, be right which promotes the good of the community or of the larger community of the two. I know an action to be right, partly by my reason exercised on its effects and on the effects of actions similar to it, partly also by that "inward instinct, according to the law of conscience, which is a relic of man's ancient purity," and partly too by the words of God's Revelation. What impels me to do an action, when I know it to be right, is partly obedience to the Will of God, hope of His rewards, and fear of His punishments; partly, a natural appetite, impressed on me as on all other objects, to seek good, and to seek the greater good rather than the lesser. That two or more inconsistent modes of thought are implied in these answers, I am aware. But Bacon and his generation had not yet reached that stage in the history of ethical speculation when thought on these subjects was clear and consistent.

Of the precepts for the Georgics or husbandry of the mind, I have no space to give any detailed account, interesting as some of them are. The whole disquisition on moral philosophy is concluded by drawing a parallel between the good of the mind and the good of the body. The good of the body consists of health, beauty, strength, and pleasure. "So, the good

of the mind, if we view it as informed by Moral Philosophy, tends to this: to be sound and free from the perturbations of passion; to be beautiful and adorned with the ornaments of true comeliness; to be strong and agile for undertaking all manner of duties; lastly, not stupid, but retaining a vivid sense of pleasure and of all the honourable solaces of life. For it is easy to see that many have strength of wit and courage, who are nevertheless troubled by passions, and whose manners bear scarce any marks of grace or elegance; some again have abundance of grace and elegance, who have no probity of mind to will or strength to be able to act rightly; others again there are who, though endowed with a sense of honour and a blameless character, are neither an ornament to themselves or of any service to the state; while others, though perhaps endowed with all these three qualities, yet, from a stoical severity and insensibility, have no pleasure in the virtuous actions which they practise."[3]

Before quitting this portion of my subject, I ought perhaps briefly to notice Bacon's conception of what he calls Primary Philosophy.[4] "Because the distributions and partitions of knowledge are not like several lines that meet in one angle, and so touch but in a point, but are like branches of a tree that meet in a stem, which hath a dimension and quantity of entireness and continuance before it come to discontinue and break itself into arms and boughs; therefore it is good, before we enter into the distribution [of the sciences], to erect and

[3] Dr. Abbott's assertion that "Machiavelli was unquestionably Bacon's guide, if not in theoretical, at all events in practical morality," has been examined, and I trust refuted, by me in a previous chapter. See pp. 41—45.

[4] In my description of the Primary Philosophy, I have combined the accounts given in the *Advancement of Learning*, book ii. and the *De Augmentis*, book iii. ch. 1.

constitute one universal science by the name of *philosophia prima*, primitive or summary philosophy, to be as the mother of the rest, and to be regarded in the progress of knowledge as the main and common way, before we come where the ways part and divide themselves." This philosophy, when constituted, is to be "a receptacle for all such profitable observations and axioms as fall not within the compass of any of the special parts of philosophy or sciences, but are more common and of a higher stage" (or, as it is put in the *De Augmentis*, "belong to several of them in common"). As examples of these common principles are given the axiom that "if equals be added to unequals the wholes will be unequal," which is a rule both "of mathematics and of distributive justice;" the axiom that "things that agree with one and the same third thing agree with one another," which is a rule both of mathematics and logic; the maxim that "Nature best shows itself in its smallest portions," which suggested the atoms of Democritus in Physics, and yet led Aristotle, in his Politics, to begin his inquiry into the nature of a commonwealth with the family. A collection of such axioms would be "a thing of excellent use for displaying the unity of nature." To this collection of common axioms Bacon adds in the *De Augmentis*, as another part of the Philosophia Prima, the inquiry into "the adventitious conditions of beings," or "Transcendentals," as he proposes to call them, such as Much and Little, Like and Different, Possible and Impossible, also Being and Not-Being, &c. But the inquiry into the nature of these Transcendentals in the Primary Philosophy must be "a real and solid inquiry, according to the laws of nature and not of language." Thus, for instance, it must endeavour to assign a reason why some things in nature are and can be so numerous and plentiful, others so few and scanty; and, again, why between different species there are always interposed certain connecting links ("participia") of doubtful

species, "as moss between corruption and a plant, bats between birds and quadrupeds," and so on.

It is singular that, in the *Novum Organum*, the functions of Primary Philosophy are assigned to Natural Philosophy, the "great mother of the sciences," the "trunk" from which if the individual arts and sciences be separated, they cannot grow,[5] while some of the common axioms with which the Primary Philosophy deals occur as examples of the Instantiæ Conformes or Parallel Instances.[6] Both in describing the relation of the individual sciences to Natural Philosophy and in bringing together his "Parallel Instances," the predominant idea in Bacon's mind seems to be that of the unity of nature amidst all its variety.[7]

The student of Ancient Philosophy will not fail to compare with Bacon's conception of the Primary Philosophy that "synoptical view of the relationship of the various sciences one with another and with the nature of real being,"[8] in the study of which the young philosophers of Plato's Republic are to spend ten years of their lives, after they have studied the sciences separately as boys, and before they enter on the supreme science of Dialectic or the study of Being in itself. What, however, suggested to Bacon the name, and what really corresponded more to his own conception than he seems to have

[5] See *Nov. Org.* book i. aphs. 79, 80, and my notes on these aphorisms.

[6] *Nov. Org.* book ii. aph. 27.

[7] The idea of the unity of science is the complement of that of the unity of nature, each implying the other. "Let all divisions of knowledge," says Bacon (*De Augmentis*, book iv. ch. 1), "be understood and employed" rather for lines to mark or distinguish, "than for sections to cut and separate; in order that solution of continuity in sciences may always be avoided. For the contrary hereof has made particular sciences to become barren, shallow, and erroneous."

[8] See Plato's *Republic*, book vii. p. 537 b, c.

imagined, was the πρώτη φιλοσοφία or θεολογία of Aristotle, contained in the books subsequently called Meta-physica. Aristotle's object in this "Science of Being" was, like Bacon's, to consider Nature in its more general aspects and to discuss those principles and ideas which are common to many or to all the sciences.

Bacon's conception should be enlarged into what I may call the Science of the Sciences (Wissenschaftslehre), and then it represents what seems to me to be a most important branch both of knowledge and education. In addition to the several individual sciences, dealing with man or external nature, there is room for another or general science, whose function it should be to consider these individual sciences in their relations one to another, to discuss their leading principles and dominant ideas, whether common to all or some sciences or peculiar to each individual science, and to note, as distinct from Logic (which should deal with methods in their ultimate analysis), the various forms and combinations which the logical methods assume when applied to the investigation or elucidation of the different departments of knowledge. Towards such a science or philosophy several recent writers have made large and important contributions, nor were those of Bacon himself, as contained in the *De Augmentis* and some portions of the *Novum Organum*, by any means contemptible.

In concluding this division of the chapter, I must again remind the reader that Bacon's merit does not consist in his philosophical teaching in the proper sense of the term, but in his assertion of the necessity of a new method, of a new range of studies, of a new spirit of inquiry. With the ultimate nature and conditions of knowledge and being he did not much concern himself, so long as he could arrive at what was practically true for man, and could certify to himself the steps by

which he had arrived at it. He was a logician, in the widest and fullest sense of the word. A philosopher he did not claim to be; and though I believe that his works exerted a very powerful influence on the philosophical speculations of the two succeeding centuries, a philosopher, in the strict sense of the term, he was not.

Two of the most striking Aphorisms in the First Book of the *Novum Organum*[9] are the 65th and 89th. The former has already been translated on pp. 97, 98, to which the reader should refer back. In the latter, speaking of the causes of the slight progress hitherto made by men in the sciences, Bacon says: "Nor is this reason to be passed by, that natural philosophy has in all ages found a troublesome adversary and one hard to deal with; namely, superstition and a blind and immoderate zeal for religion." And again: "But in such mixtures of theology with philosophy, those things only are comprehended, which are now received in philosophy; but whatever is new, though the change be for the better, is all but expelled and exterminated." And he sums up as follows: "But to him who truly considers the matter, natural philosophy is, after the word of God, the surest remedy against superstition, as well as the most approved nourishment for faith. And hence she is rightly given to religion as her most faithful handmaid; since the one shows the will of God, and the other His power."

Now it appears to me that these passages, and the complete separation which he there advocates between theology and science, furnish the best key to Bacon's religious opinions, and, at the same time, afford an explanation of the almost constant

[9] The remarks which follow on Bacon's Religious Opinions are taken, with slight alterations, from § 7 of my Introduction to the *Novum Organum*.

disputes which have been carried on nearly from his own times to ours as to what the nature of his religious opinions really was. It is easy to see that a man who penned the above sentences might readily be suspected of harbouring in his mind a still greater mistrust of theological conclusions than he overtly expresses; and it is, at the same time, I think, no less easy to see, if we know anything of the history of opinion, that the maxims expressed might in Bacon's age, when speculations of this kind and the comparison of conclusions arrived at in different branches of knowledge were comparatively rare, be uttered, even by a man of the most religious temperament, in perfect good-faith.

I am myself of opinion not only that the religious side of these Aphorisms expresses Bacon's sincere convictions, but also that he did not materially dissent from the religious teaching which was generally current in his day on what may be called the fundamental doctrines of Christianity.

Any reader who wishes to arrive at an independent opinion on this point ought carefully to compare the following references (which are too long to be extracted): *Nov. Org.* i. 65, 89; *De Augmentis*, book i. (E. and S., vol. i. pp. 433—437), iii. 2, iii. 4, ix. throughout; *Essays on Unity in Religion, Atheism, and Superstition;* and, lastly, Bacon's formal *Confession of Faith*.[1] Of this last piece, however, it should be stated that it first appeared in the *Remains* (1648), and that, as it is described in the Harleian MS. as by *Mr.* Bacon, it must have been written before the summer of 1603. Thus, it may possibly (though I have no positive reason for saying that it is so) enter into more minute details of doctrine than Bacon would afterwards have been disposed to do. To the *Christian*

[1] For this document see Ellis and Spedding's Edition of Bacon's *Works*, vol. vii. pp. 215—226.

Paradoxes I do not refer, as being now known to have been written by another hand.

On carefully considering these and the other passages in which Bacon alludes to religion, or handles religious subjects, the impression left on my mind may be summed up in the following conclusions.

1st. Notwithstanding his admiration for the philosophy of Democritus, and his rejection of Final Causes from the domain of Physics,[2] he retained an unwavering faith in the existence of the Supreme God, the creator and fashioner of the universe. The following well-known sentences from the *Essay on Atheism* (published, it must be recollected, in its corrected form by Bacon's own authority in 1625, the year before his death) express, I believe, the most sincere convictions of his heart: "*I had rather believe all the fables in the Legend, and the Talmud, and the Alcoran, than that this universal frame is without a mind. And therefore God never wrought miracle to convince atheism, because his ordinary works convince it. It is true, that a little philosophy inclineth man's mind to atheism; but depth in philosophy bringeth men's minds about to religion. For while the mind of man looketh upon second causes scattered, it may sometimes rest in them, and go no further; but when it beholdeth the chain of them, confederate and linked together, it must needs fly to Providence and Deity.*"

2nd. I cannot question that Bacon also accepted the doctrine of a Divine Providence and a providential order of the world. This, in fact, is implied in the above passage. But there are still more explicit statements on this subject in *De Augmentis*, ii. 11, and iii. 2 of the same work. These passages must have passed under Bacon's hands and received his final approval as late as 1622 or 1623.

[2] On this subject, see pp. 143—147.

3rd. If we compare *De Augmentis*, book i. (E. and S., vol. i. pp. 483, 484), book iv. ch. 1. (p. 585), and book iv. ch. 3 (pp. 605, 606), we shall, I think, conclude that, while Bacon had no doubt as to the immortality of the soul, he was, like some of the early fathers, inclined to regard the belief as resting rather on a direct revelation from God than on a necessary, or perhaps even legitimate, conclusion of human reason.

4th. With respect to the Christian mysteries, Bacon seems, at least in his earlier years, to have been inclined to trust himself to the guidance of the church; meaning, doubtless, the church as understood by Anglican Divines, who, passing over the intermediate times of Roman superstition, boasted of their now restored connexion with the age of the primitive fathers. "But there still remains," he says, at the beginning of the last Book of the *De Augmentis*, "Sacred or Inspired Theology; whereof, however, if I proceed to treat, I must step out of the bark of Human Reason, and pass into the ship of the Church, which is only able to direct its course aright by the use of the divine compass." How far Bacon's confidence in the "ship of the church" was implicit, and without exception, is, I think, somewhat doubtful. For it is a notable fact (which I have not seen elsewhere noticed) that the passage on the nature and attributes of God, including certain statements on the Trinity and the division of the elect and reprobate, which occurs towards the end of the *Advancement of Learning*, is altogether left out in the *De Augmentis*, published eighteen years afterwards. Nor, generally, do I notice in Bacon's later works any disposition to enter into details on the more specific doctrines of religion.[3]

[3] Macaulay (*Essay on Bacon*) says, on the whole, very truly: "He loved to dwell on the power of the Christian religion to effect much that the ancient philosophers could only promise. He loved to consider that religion as the bond of charity, the curb of evil passions, the consolation

5th. Connected with this fact, is the very wide toleration which he was evidently ready to concede to dissidents from the more generally received theological opinions. Witness the following passages from the essay *Of Unity in Religion:* "Concerning the Bounds of Unity; the true placing of them importeth exceedingly. There appear to be two extremes. For to certain zelants all speech of pacification is odious. *Is it peace, Jehu? What hast thou to do with peace? turn thee behind me.* Peace is not the matter, but following and party. Contrariwise, certain Laodiceans and lukewarm persons think they may accommodate points of religion by middle ways, and taking part of both, and witty reconcilements; as if they would make an arbitrement between God and man. Both these extremes are to be avoided; which will be done, if the league of Christians penned by our Saviour himself were in the two cross clauses thereof soundly and plainly expounded: *He that is not with us is against us;* and again, *He that is not against us is with us;* that is, if the points fundamental and of substance in religion were truly discerned and distinguished from points not merely of faith, but of opinion, order, or good intention.

of the wretched, the support of the timid, the hope of the dying. But controversies on speculative points of theology seem to have engaged scarcely any portion of his attention. In what he wrote on Church Government he showed, as far as he dared, a tolerant and charitable spirit. He troubled himself not at all about Homoousians and Homoiousians, Monothelites and Nestorians. He lived in an age in which disputes on the most subtle points of divinity excited an intense interest throughout Europe, and nowhere more than in England. He was placed in the very thick of the conflict. He was in power at the time of the Synod of Dort; and must for months have been daily deafened with talk about election, reprobation, and final perseverance. Yet we do not remember a line in his works from which it can be inferred that he was either a Calvinist or an Arminian." I am disposed, however, to think that this description applies with more complete accuracy to Bacon's later than his earlier state of feeling on these subjects.

This is a thing may seem to many a matter trivial, and done already. But if it were done less partially, it would be embraced more generally." "Concerning the Means of procuring Unity; men must beware, that in the procuring or muniting of religious unity they do not dissolve and deface the laws of charity and of human society. There be two swords amongst Christians, the spiritual and temporal; and both have their due office and place in the maintenance of religion. But we may not take up the third sword, which is Mahomet's sword, or like unto it; that is, to propagate religion by wars or by sanguinary persecutions to force consciences; except it be in cases of overt scandal, blasphemy, or intermixture of practice against the state; much less to nourish seditions; to authorize conspiracies and rebellions; to put the sword into the people's hands; and the like; tending to the subversion of all government, which is the ordinance of God. For this is but to dash the first table against the second; and so to consider men as Christians, as we forget that they are men. Lucretius the poet, when he beheld the act of Agamemnon, that could endure the sacrificing of his own daughter, exclaimed:

Tantum Relligio potuit suadere malorum:

What would he have said, if he had known of the massacre in France, or the powder treason of England? He would have been seven times more Epicure and atheist than he was. For as the temporal sword is to be drawn with great circumspection in cases of religion; so it is a thing monstrous to put it into the hands of the common people. Let that be left unto the Anabaptists, and other furies. It was great blasphemy when the devil said, *I will ascend and be like the Highest;* but it is greater blasphemy to personate God, and bring him in saying, *I will descend, and be like the prince of darkness:* and what is it better, to make the cause of religion to

descend to the cruel and execrable actions of murthering princes, butchery of people, and subversion of states and governments? Surely this is to bring down the Holy Ghost, instead of the likeness of a dove, in the shape of a vulture or raven; and set out of the bark of a Christian church a flag of a bark of pirates and Assassins. Therefore it is most necessary that the church by doctrine and decree, princes by their sword, and all learnings, both Christian and moral, as by their Mercury rod, do damn and send to hell for ever those facts and opinions tending to the support of the same; as hath been already in good part done. Surely in counsels concerning religion, that counsel of the apostle would be prefixed, *Ira hominis non implet justitiam Dei.* And it was a notable observation of a wise father, and no less ingenuously confessed; *that those which held and persuaded pressure of consciences, were commonly interested therein themselves for their own ends.*"

Here we seem to detect the first note of the key which was afterwards struck with such effect by Chillingworth in his *Religion of Protestants*, by Jeremy Taylor in his *Liberty of Prophesying*, and, above all, by Locke in his *Letters on Toleration.* And, like these writers, Bacon probably did not see the consequences of his own principles. Like them, he would probably have set limits to Toleration, nor am I sure that he would not have set precisely the same limits as Locke, namely, by excluding "Papists" on the one side and "Atheists" on the other. As in the case of Locke, too, and, perhaps, of all who advocated Toleration in those days, when the true principles of Political Philosophy were so imperfectly understood, Bacon's zeal against persecution and intolerance arose, probably, in no small measure, from vagueness, uncertainty, or indifference, in his own religious beliefs.

6th. The indifference of which I have just spoken was, I think, certainly one of Bacon's characteristics in relation to

religious controversies. It was not merely that he saw the hollowness or absurdity of many of the disputes current in his own day. "A man that is of judgment and understanding shall sometimes hear ignorant men differ, and know well within himself that those which so differ mean one thing, and yet they themselves would never agree." "Men create oppositions which are not; and put them into new terms so fixed, as whereas the meaning ought to govern the term, the term in effect governeth the meaning."[4] A man so acute as Bacon could not help seeing thus far, but his indifference, I think, extended far beyond the range of these mere verbal quibbles and scholastic combats. His indifference was not simply an indifference of the head; it was an indifference of the heart. What he really cared for was the advancement of science, the knowledge of nature, the extension of the kingdom of man. He did not repudiate religion, or even theology; rather, he was a respectful, though silent, worshipper; but, like many another man, he entered the shrine only on occasion, while, at most times, his business lay far away. There was, perhaps, a latent feeling that not much knowledge was to be had in these subjects, numerous and eager as were the workmen engaged in attempting to extract it; while, in the wide field of nature, the harvest was ready, though the labourers were few. And so Bacon contented himself with working in what appeared to him the more promising field of labour. He sought God in nature, and there he recognized, reverenced, and adored Him. The same God was also to be found in the ark of the Church, and the pages of the Bible; but Bacon's tastes and pursuits lay another way, and hence, though he had no inclination to call in question the leading verities of faith, he received them,

[4] *Essay of Unity in Religion.* These passages do not occur in *the Essay of Religion*, published in 1612, and, consequently, they first appeared in 1625.

always without enthusiasm, and sometimes, even, with apparent indifference.

7th. This last consideration may afford some explanation of the two other points to which I shall call attention. One of these is the evident preference which Bacon accords to Atheism over Superstition. "It were better to have no opinion of God at all, than such an opinion as is unworthy of Him. For the one is unbelief, the other is contumely: and certainly superstition is the reproach of the Deity. Plutarch saith well to that purpose: *Surely* (saith he) *I had rather a great deal men should say there was no such man at all as Plutarch, than that they should say that there was one Plutarch that would eat his children as soon as they were born;* as the poets speak of Saturn. And as the contumely is greater towards God, so the danger is greater towards men. Atheism leaves a man to sense, to philosophy, to natural piety, to laws, to reputation; all which may be guides to an outward moral virtue, though religion were not; but superstition dismounts all these, and erecteth an absolute monarchy in the minds of men. Therefore atheism did never perturb states; for it makes men wary of themselves, as looking no further: and we see the times inclined to atheism (as the time of Augustus Cæsar) were civil times. But superstition hath been the confusion of many states, and bringeth in a new *primum mobile*, that ravisheth all the spheres of government." [5] In this passage, I think, Bacon thoroughly represents the spirit of his time. The recoil from the superstitions of the Church of Rome, and especially from the dangers with which the machinations of that Church seemed to threaten the civil power, had become, in the reformed countries, so intense, and

[5] *Essay of Superstition.* Cp. a letter to Toby Matthew on his conversion to Romanism (Spedding's *Letters and Life*, vol. iv. p. 10), where we find pretty nearly the same words as those contained in the beginning of this quotation.

almost so unreasoning, that men could conceive of no opinions equally dangerous either to the well-being of the individual conscience or to the security of the state. It required experiences like those of the French Revolution to convince men that the dissolution of the restraints of religion, in minds which from infancy had been accustomed to them, might be even still more desolating in its effects on morals and government. And meanwhile, this view, as stated by Bacon, bore fruit and multiplied. The undiscriminating denunciation of Superstition in the seventeenth century, coupled with the freer mode of inquiry into the fundamentals of religion which marked the close of the period, terminated in results, which, however much he may have contributed to them, he would probably have been among the last to welcome.

8th. The last point which I shall notice is also one which had a great and undoubted effect on subsequent speculation. The interests of Bacon, as we have seen, were in the progress of science. What he, above all things, desired was a clear and unimpeded course for his favourite pursuit. Now he could never forget (or the divines and controversialists of his time would never have allowed him to forget) what he states so emphatically in a passage of the *Novum Organum*, already quoted, on the bitter and perennial opposition between Natural Philosophy and the blind and immoderate zeal for religion. What then so effectual, and what so obvious, as to declare an entire separation between the spheres of Science and Theology, of Reason and Faith? Their admixture had made the one fantastic, and the other heretical. The remedy, therefore, was to put them asunder; to give to reason the things of reason, and to faith the things of faith. Then, the one would declare the Will of God, and the other His Power. Nor was the idea of this truce, I think, suggested solely by the motive of preserving the rights of science. It was in perfect sincerity, I

think, that Bacon wrote: "Let us then conclude that Sacred Theology ought to be drawn from the word and oracles of God, not from the light of nature or the dictates of reason. For it is written, 'The heavens declare the glory of God;' but it is nowhere written, 'The heavens declare the will of God.'" The method of the Scholastics had been thoroughly vicious, both in applying Scripture to establish the principles of science, and in applying reason to establish the principles of religion. Far different was the procedure recommended by Bacon both in the one case and the other. "But with regard to inferences, we ought to know that there is left us an use of reason and argument (as to mysteries) secondary and respective, though not original and absolute. For, after the articles and principles of religion have been set in their place, so as to be completely exempted from the examination of reason, it is then permitted us to derive and deduce inferences from them according to their analogy. In nature indeed this holds not. For both the principles themselves are subject to examination, by Induction, I mean, though not by Syllogism, and, besides, these same principles have no discordance with reason, so that the first and middle propositions are derived from the same fountain. It is otherwise in religion, where the first propositions are not only self-existent and self-supporting, but likewise unamenable to that reason which deduces consequent propositions."[6] That it did not occur to Bacon to ask on what grounds the authority of Scripture isself reposed, may to us appear strange, but this was not one of the questions which the men of that age were in the habit of putting either to themselves or others. I see no reason to doubt that Bacon accepted the authority of Scripture as an ultimate fact, though, as I have already intimated, he may, especially towards the latter period of his life, have felt some hesitation as to the truth or exactitude of some of

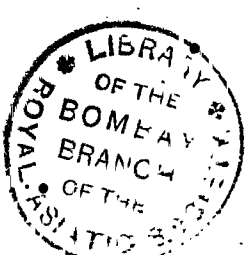
[6] *De Augmentis*, book ix.

the dogmatic inferences which had been deduced from its language.

This sharp separation of Religion and Science, Faith and Reason, probably exercised a considerable influence on the turn which these speculations took amongst Bacon's successors. Hobbes, while he showed no disposition to restrict scientific discussions, relegated religion altogether to the cognizance of the magistrate. It was the duty of the state to provide a religion for its subjects, and these had nothing to do but to accept it without doubt, or, at least, without any expression of doubt. Thus, the sphere of religion was removed altogether from the arena of discussion, and we seem here to have almost a parody of some of the principles propounded by Bacon. Pascal, though whether he was influenced by the writings of Bacon or not I have no sufficient grounds for determining, attempted to make the divorce between Faith and Reason complete, in the interests of Religion, as, at a later period, Hume did, or pretended to do, in the interests of Philosophy. Locke, though he took a great interest in theological questions and himself wrote theological works, shows no disposition either, on the one hand, to question the authority, or even the infallibility, of the Scriptures, or, on the other hand, to allow them to exert any influence on his philosophical speculations. Bayle tries to exaggerate the discrepancies between philosophy and religion, but, not having the robust faith of Bacon or Locke, he seems, with some hesitation, ready to sacrifice the claims of religious belief to the exigencies of human reason. But, however it may have been with particular individuals, I cannot question that the general tendency, predominant, especially in England, till quite recently, to draw a distinct line of demarcation between the spheres of religion, on the one side, and philosophy and science, on the other, and to combine a sincere belief in the traditional teaching of the Bible or the

Church with a perfect independence in the sphere of speculation, *is due* in large measure, to the teaching and example of Bacon. Whether this procedure be or be not legitimate, this is not the place to inquire.[7]

[7] In writing these paragraphs on Bacon's religious opinions, I have, of course, read carefully the considerable portion of his work which Kuno Fischer devotes to the same subject. But my conclusions, many of which agree with his, had almost all been previously arrived at by an independent study of Bacon's writings.



CHAPTER VI.

BACON'S INFLUENCE ON PHILOSOPHY AND SCIENCE.

FEW questions in the history of Philosophy and Science have been more keenly debated than the fact and nature of Bacon's influence on these pursuits. Some writers have gone so far as to maintain that both philosophy and science would have been exactly in the same position that they now are, if he had never lived. As I can by no means subscribe to this position, and should certainly not have undertaken to write this book, had I believed it to be even approximately true, I shall endeavour in this Chapter briefly to indicate what I conceive to have been the nature of Bacon's influence, as well as to assign some grounds for my own opinion that in both departments it has been very considerable, while, as respects science properly so called, the impulse and direction given to it by Bacon were of the very highest importance.

As I am dealing with two distinct questions, I shall ask, first, what was the influence of the Baconian Reform on Philosophy (under which head I include all inquiries into the grounds, conditions, and character of human knowledge and human practice), and second, what was its influence on Science (a word which I take in its modern sense, as restricted to inquiries into the constitution and modes of action of corporeal objects).

With respect to the first question, I may state strongly my own belief, grounded on a careful study of their works, that the most characteristic school of English psychologists and moralists, and, through them, a most important school of European philosophy, has been profoundly influenced by the method and speculations of Bacon. The main principle of Locke's *Essay*, namely, that all our ideas are derived from either sensation or reflection, appears to me to be contained in germ in the 1st Aphorism of the *Novum Organum*, while to the attentive reader there can be no doubt that his whole mode of treating psychological questions is thoroughly imbued with the spirit of Bacon's method. What Bacon himself says (*Nov. Org.* i. 127), that the Inductive Method is as applicable to Logic (here used as a general term for the study of mind), *Ethics*, and *Politics*, as to Natural Philosophy, is admirably exemplified in the writings of Locke. It is true that, in the *Essay*, Locke never expressly mentions Bacon's name, but then the frequent citation of authors' names was not a fashion of that time, as it has come to be of ours. In the short work, however, *On the Conduct of the Understanding*, the direct references to Bacon are frequent. Thus, at the very beginning, he justifies his own opinions on the insufficiency of the "Logic now in use" by the authority of the "great Lord Verulam, who not servilely thinking that learning could not be advanced beyond what it was, because for many ages it had not been, did not rest in the lazy approbation and applause of what was, because it was; but enlarged his mind to what might be." Locke is generally and justly regarded as the father of at least the English and French schools of Psychology, and hence to connect Bacon with Locke is to connect him with Berkeley, Hume, Hartley, Reid, Stewart, the two Mills, Condillac, Helvétius, Destutt de Tracy, to say nothing of less known or more recent writers. Again, I think it would be difficult for

any one, after carefully reading the 7th Book of the *De Augmentis* and after tracing the obvious applications of Bacon's principles and method to the science of conduct, to resist the conclusion that his speculations and, perhaps still more, his method of investigation are, to a large extent, the source of that great school of moral philosophy which, numbering men so widely divergent in many respects as Hobbes and Cumberland, Butler and Bentham, agrees in basing the rules of conduct on an inductive examination of the principles of human nature and the consequences of human actions. English philosophers, whether moralists or psychologists, or, at least, much the larger number of them, seem to me to be thoroughly Baconian in their aims, in their spirit, and in their method. In the eyes of many this may be a reproach, but, if it be true as a fact, it will go far towards establishing a conclusion as to the influence of Bacon over one large and important department of investigation.

Before leaving this branch of my subject, it is only fair to mention one very peculiar circumstance connected with it. Hobbes had, in early life, been Bacon's secretary, but, though he wrote a work expressly on *Computation or Logic*, there is no mention in it of Induction, of the Baconian method, or of Bacon himself. It is, perhaps, still more singular that there is no mention of Bacon in the Epistle Dedicatory to the *Elements of Philosophy*, where he refers to Galileo, Kepler, Harvey, Gassendi, Mersenne, &c. Bacon's name, *in fact*, so

[1] De Rémusat, whose remarks on Hobbes (*Bacon*, pp. 405—408) seem to me very just and interesting, says that, to the best of his belief, the word Induction occurs only once in Hobbes' writings. This is in a mathematical controversy with Wallis (Molesworth's Ed., *Latin Works*, vol. iv. p. 179), where he says, in a spirit the very reverse of Baconian: "Inductio autem demonstratio non est, nisi ubi particularia omnia enumerantur, quod hic est impossibile." (But Induction has not the force of demonstration, except where all the particulars are enumerated, which is here impossible).

far as I am aware, occurs only twice in the whole of Hobbes' works, and there without any epithet of praise or blame. From the extent of Hobbes' writings and the intimate personal relations which had formerly existed between him and Bacon, I can hardly refer this silence to mere accident. It may have been due to some personal pique, or the abstract character of Hobbes' mind may have rebelled against the concrete and inductive spirit of Bacon's philosophy. For, it may be noticed that there are few writers on moral and political questions, in whose works the historical spirit is more conspicuously absent than in Hobbes.

The second question is, to my mind, much more difficult to answer than the first, though I can entertain no doubt that *Bacon has exerted a real and beneficial influence on the subsequent progress of science.* The extent of this influence, however, and its precise character are not easy to determine.

In the Introduction to my Edition of the *Novum Organum* (§ 14), I have adduced a large number of testimonies to the estimation in which Bacon's works on the reform of science and scientific method were held from the time of his contemporaries and immediate successors down to the middle of the eighteenth century, when the "Baconian Philosophy" and the "Baconian Method" had come to be almost universally regarded as terms expressive of accurate and fruitful investigation in every department of science. These testimonies include those of Descartes, Mersenne, Gassendi, Peiresc, Du Hamel, Bayle, Voltaire, Condillac, D'Alembert in France; Vico in Italy; Comenius, Puffendorf, Leibnitz, Huygens, Morhof, Boerhaave, Buddæus in Germany; and, in England, the group of men who founded or were amongst the earliest members of the Royal Society, such as Wallis, Oldenburg, Glanvill, Hooke, and Boyle. Not only do these writers speak

with approbation of Bacon's method, but most of them also furnish evidence of the impulse which he gave to scientific inquiry and the direction which he impressed upon it. Indeed there can be little doubt that the foundation of the Royal Society in England, and possibly the same origin may be assigned to some similar societies on the Continent, was due to the impulse given by Bacon to the study of experimental science and the plans which he had devised for its prosecution. A review of the whole evidence leads me to the conclusion that there can be no question as to the reality of his influence on the progress of science in the generation immediately succeeding his own, though as to the extent and nature of that influence there is room for considerable difference of opinion. When we arrive at the end of the seventeenth century, a generation later, we are, in England at least, in the full tide of experimental research, and at that time, I believe, the value and influence of Bacon's writings had come to be universally acknowledged.[2]

When we have established the fact of Bacon's influence on the progress of science, it remains to ask what the nature of that influence was. The title of founder or father of experimental philosophy, so often ascribed to him by his admirers and so often criticised by his detractors, expresses the nature of his influence, I think, in a rough, and, perhaps, a somewhat

[2] I have not thought it desirable to enter here on the vexed question of Bacon's influence on Newton. In the Introduction to my edition of the *Novum Organum* (§ 14), I have examined it with tolerable fulness, and the conclusion which, on a review of all the circumstances, I am inclined to adopt is that "Newton had not studied, or did not remember, or did not accept the teaching of the early part of the Second Book of the *Novum Organum*, though the precepts and warnings of the First Book, in their most general form, had produced a deep impression upon him and had, in great measure, suggested to him the aims and methods of his own investigations."

exaggerated as well as a somewhat inadequate form, but one which I regard as being, in the main, true. Instead, however, of examining this or similar expressions, it will be a simpler and perhaps a more useful course to state precisely the conclusions on this subject at which I have myself arrived.[3]

1st, He called men, as with the voice of a herald,[4] to lay themselves alongside of nature, to study her ways, and imitate her processes. To use his own homely simile, he rang the bell which called the other wits together.[5] Other men indeed had said much the same thing in whispers or in learned books written for a circle of select readers; but Bacon cried it from the house-tops, and invited all men to come in freely and partake of the feast. In one word, he popularised the study of nature.

2nd, He insisted, both by example and precept, on the importance of experiment as well as observation. Nature, like a witness, when put to the torture, would reveal her secrets. Experimentation was undoubtedly common in Bacon's time, but it was generally associated with the Alchemists, and so, while it suffered in reputation, it was confined in range. Bacon gave it an extension, a dignity, a popularity which, it is not too much to say, must have materially influenced the labours of the Royal Society, and the crowning efforts of Boyle and Newton.

3rd, In both these ways, Bacon recalled men to the study of facts, and though, in the first instance, he had mainly in view the facts of external nature, the influence of his teaching soon extended itself, as he undoubtedly purposed that it should

[3] The remainder of this Chapter is taken verbatim from the Introduction to my Edition of the *Novum Organum*, § 14.

[4] Thus, he says of himself (*De Augm.* iv. 1 ad init.): "Ego enim buccinator tantum," &c.

[5] "I have only taken upon me to ring a bell to call other wits together." Letter to Dr. Playfer, printed in Spedding's *Letters and Life*, vol. iii. p. 301.

do, to the facts of mind, conduct, and society. The *inductive* study of Mental, Moral, and Political Philosophy, which has been the distinctive characteristic of the best English thought from the end of the seventeenth century onwards, is, it seems to me, no less really, though I grant it is less obviously, a result of the Baconian teaching than the inductive study of Natural Philosophy.

4th, In order to set men free to study facts, it was necessary to deliver them from the pernicious subjection to authority, to which they had so long been enslaved. Here and there throughout the Middle Ages, a solitary thinker, like Roger Bacon, may have asserted his independence, and, during the century preceding Bacon's time, the murmurs of discontent had been becoming loud and frequent, but it required a clear, shrill voice, like that of the author of the *Great Instauration*, effectually to awaken men from their slumber. Bacon seems to have been thoroughly impressed with the feeling that there was no hope for human fortunes, unless these bonds could be broken; and hence the tone of intended and conscious exaggeration with which he often sets about this task, as is especially the case in the *Temporis Partus Masculus* and some parts of the *Novum Organum*. Nor can I doubt that his utterances on this subject had far more influence in producing the intellectual revolution which followed than the utterances of any one of his predecessors, or, perhaps, than those of all taken together. It would hardly, I think, be an exaggeration to compare Bacon, in the intellectual sphere, with Luther, in the sphere of religion. And, in truth, there was much in common between the two men. Both of them were intensely impressed with the importance and reality of their mission; both of them were grimly in earnest; both of them spurned all obstacles in existing opinion, and even exaggerated the differences between themselves and their opponents; and, lastly, each of them re-

tained, far more than he suspected, the habits of thought, the more deeply engrained prejudices, and even the more misleading forms of expression of his time. Each of them, in fact, sowed the seed, without knowing altogether clearly what manner of fruit it was likely to bring forth.

5th, Hardly less important than deliverance from the bondage of authority was the emancipation of reason from the bewitching enchantments of imagination. "Hypotheses non fingo" was a maxim which Newton inherited directly from the teaching of Bacon. And, though the reaction against hypothesis was carried much too far, and though Bacon's utterances on this subject, to be serviceable at the present time, require much rectification, the warning was one which, in his own time, was sorely needed, and which could hardly be expressed in language too emphatic. Where authority was wanting, as if by way of revenge, men seemed to put no limit to the wildness of their fancies or the extravagance of their suppositions. Now, as against both authority and hypothesis, Bacon invoked the majesty of facts. The office of Reason, he was, in effect, constantly saying, ought not to be limited to an examination of the conclusions and their dependence on the premisses; what it ought to insist on doing, is to examine the premisses themselves. What is required is a new Logic, a Logic of Induction, which shall do for the premisses what the old Logic, the Logic of Deduction, does for the conclusions. It is not enough that the conclusion follows from the premisses; what we require to know is whether the premisses themselves be true, and, unless we can succeed in satisfying this want, we may simply be multiplying error instead of advancing truth. Had this been the only lesson which Bacon read to his generation, he would, assuredly, have deserved to be reckoned amongst the greatest of its benefactors.

6th, But to this Logic of Induction I maintain that he

himself made no contemptible contributions. That our instances require to be selected and not merely accumulated, was a very true and a very needful lesson which he was never weary of repeating. And, surely, in this maxim consists the whole gist of the Inductive Logic. On what principles we shall select our instances, and by what means we shall satisfy ourselves of their sufficiency, are other and further questions, confessedly most difficult to answer, on which we could hardly expect much detailed or permanently useful information from a pioneer in this method of inquiry. And yet Bacon is very full on at least the first of these questions, and much of what he says has, even still, a value for the student. But we are here concerned, we must recollect, not with the present value of his works, but with their past influence. Now, to the amount of that influence, with respect to the subject before us, what better testimony can we have than the repetition of these rules in the next generation by so eminent a man of science as Dr. Robert Hooke, or the appropriation, emendation, and formulation of them, as the bases of their own methods, almost within our own time, by Sir John Herschel and Mr. Mill? Nor is it an unimportant consideration that such phrases as "glaring instance," "crucial instance," "clandestine instance," "solitary instance," and the like, have become household words in our language, and especially in the vocabulary of scientific men.

7th, The manner in which he insisted on the subordination of scientific inquiries to practical aims, the furtherance of man's estate and the increase of his command over the comforts and conveniences of life, is another point in which, I think, Bacon profoundly influenced succeeding generations. That his view was too exclusive, and his language exaggerated, I readily own; but here again, as in criticising the abuse of authority and imagination, I think it difficult to deny that his influence

was, on the whole, most beneficial. When we recollect the frivolous character of many of the questions which men of the most brilliant abilities were then in the habit of disputing, and the profound misery or discomfort in which the mass of mankind, then even more than now, was sunk, we can hardly feel surprise or regret that a great statesman and a great philosopher should have suggested the application of man's intellectual endowments to the improvement of his material condition.

8th, Nor must we forget the hopefulness of Bacon as an important element in his influence. Men who despair of mankind and of the future are, happily, seldom successful in persuading others to accept their advice or their systems. There is a healthy instinct in man which leads him to believe that the future will be better than the past, and that the labours of the present generation will not be without their effect in improving the condition of the next. No man was ever inspired with this feeling more strongly than Bacon. He stood, like a prophet, on the verge of the promised land, bidding men leave, without regret, the desert that was behind them, and enter with joyfulness and hopefulness on the rich inheritance that was spread out before them. The sixth part of the *Great Instauration*, to which all the rest was subservient, the philosophy itself which was to be the result of the right employment of the method, he hoped only to begin. "The fortune of the human race," he says, "will give the issue;—such an issue, it may be, as in the present condition of things and of the minds of men cannot easily be conceived or imagined. For the object in view is not only the contemplative happiness, but the whole fortunes, and affairs, and powers, and works of men."[6]

9th, To all these sources of influence we must add the marvellous language in which Bacon often clothes his thoughts.

[6] *Distributio Operis*, ad fin.

His utterances are not infrequently marked with a *grandeur* and solemnity of tone, a majesty of diction, which renders it impossible to forget, and difficult even to criticise them. He speaks as one having authority, and it is impossible to resist the magic of his voice. Whenever he wishes to be emphatic, there is the true ring of genius about all that he says. Hence, perhaps, it is that there is no author, unless it be Shakspeare, who is so easily remembered or so frequently quoted. His phraseology, when most quaint, as in the case of the "Idols" and the "Instances," is often most attractive to the reader and most persistent in its hold on the memory. Hence, too, perhaps, it is that there is no author so stimulating. Bacon might well be called the British Socrates. Even had his individual precepts been utterly worthless, many men must have owed their first impulse to the study of nature, or to independent investigation in general, to the terse and burning words, issuing, as it were, from the lips of an irresistible commander, with which he urges them to the work.

Such, I conceive, are the principal modes and directions in which the influence of Bacon was exercised. It would be easy to add to these, but they will readily suggest others, and the limits of this work necessarily compel me to aim at brevity rather than expansion.

THE END.

GILBERT AND RIVINGTON, PRINTERS, ST. JOHN'S SQUARE, LONDON.

00026443

Digitized with financial assistance from the
Government of Maharashtra
on 18 July, 2018